A COMPARATIVE STUDY OF THE MEAN NUTRIENT INTAKES OF VARIOUS POPULATION GROUPS OF THE ELDERLY IN SASKATOON

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ABSTRACT

This survey was conducted in order to examine the dietary adequacy of three different support systems for single elderly people living alone in Saskatoon, Saskatchewan. One hundred and twenty people over the age of 65 were selected from the Alliance of Youth and the Elderly, Meals on Wheels, and the Sherbrooke Community Center. The Alliance of Youth and the Elderly helps to repair and maintain the homes of the elderly, but does not provide meal service. Meals on Wheels provides one hot meal each weekday while the Sherbrooke Community Center provides all meals and snacks.

Food consumption of subjects was recorded using the 24-hour dietary recall method. Exact quantities of food consumed were determined with the aid of food models. Socio-economic and demographic data for each individual were entered on a questionnaire, and all data were coded for computer analysis. Computer analysis utilized food composition data from the Handbook of The Nutritional Contents of Foods, U.S.D.A. No. 8, and printed out the daily intake of calories, protein, fat, calcium, iron, vitamin A, vitamin C, thiamine, riboflavin, and niacin for each individual. The effects of socio-economic and demographic variables on the caloric and nutrient intakes of the elderly subjects were determined with the analysis of variance. Adequacy of diet for the three support systems of the elderly was assessed by comparison with the recommendations made in the 1976 edition of Dietary Standard for Canada.

Results of this survey indicated that elderly males and females in the Alliance of Youth and the Elderly and Meals on Wheels met Canadian

recommended levels for calories and all nutrients. Males in the Sherbrooke Community Center did not meet recommended levels of intake for thiamine while females in the Sherbrooke Community Center exceeded recommended levels of intake for calories. Protein intakes for all subjects were affected by differences in age and sex. Protein, calcium and vitamin A intakes of all subjects were affected by differences in the type of support program. Results of this survey suggest that elderly males and females living alone at home and receiving help from the community can adequately meet their nutritional needs.

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1. INTRODUCTION

Research on the nutritional status and dietary habits of the elderly is just beginning. Although most modern surveys of the elderly use statistically accurate methods to determine calorie and nutrient intakes, no consistent relationships between nutrient intake and socio-economic conditions of the aged have been established.

The few longitudinal studies[60,63] that have been conducted on the elderly indicate that good health is important in the maintenance of a good diet. As the number of disabilities appear to increase with increasing age,[2,23] elderly people require more care from their families or communities to meet everyday needs. If the family is unable to cope with this increased demand, the elderly are often placed in nursing homes[57]. A more practical and less expensive method of assisting the elderly is to increase the quality of services presently existing in the community. One component of these services is home delivery of meals to the elderly. Results of several studies[27,48,61] suggest that meals-delivery programs can adequately meet nutritional needs of the elderly.

In the present survey, caloric and nutrient intakes were determined for three groups of elderly people, subjects living at home who were receiving Meals on Wheels; subjects living at home who were not receiving meal service of any kind; and subjects residing in an institution. The survey was undertaken in order to determine a) whether socio-economic conditions of the elderly affect caloric and nutrient intakes, and b) whether Meals on Wheels subjects could adequately meet their nutritional needs living at home.

2. REVIEW OF THE LITERATURE

2.1 Population statistics of the aged in Canada

In 1977, Statistics Canada[54] stated that greater than eight percent of the Canadian population was over 65 years of age, and that by the year 2001 this figure will reach ten percent. The aged are a rapidly growing segment of the population. Between 1961 and 1971, the number of Canadians over 65 years of age increased by 26 percent. During this same period the overall population increased by only 18 percent[16]. Improved health care and a decline in fertility rates since the late nineteenth century may account for this increase in the proportion of the elderly.

Census data reveals that 57 percent of the elderly are female. Fifty-four percent of the elderly are married, and 11 percent are not married. Thirty-five percent are widowed, and one percent are divorced.

As a group, the elderly are not as well educated as those under 65[54]. Sixty-four percent of the elderly population have less than a grade nine education. Twenty-six percent have attended high school, ten percent have post-secondary educations, and of these, two percent have obtained university degrees. These latter figures for education are significantly lower than the percentages for those aged 25 to 64.

2.2 Dietary intake surveys of the elderly in Canada

In 1970, Nutrition Canada[16] conducted a national survey in order to determine the nutritional status of Canadians. A representative sample of Canadians was assessed according to clinical evidence, anthropometric measurements, biochemical analyses and dietary intakes. Mean caloric and

nutrient intakes for elderly males and females are presented in Table 2.1.

Table 2.1: Mean[1] caloric and nutrient intakes for elderly males and females

Kilocalories and Nutrients	Male	Female
Kilocalories	2,056	1,530
Protein (g)	72	54
Fat (g)	89	63
Calcium (mg)	709	619
Iron (mg)	13	10
Vitamin A (I.U.)	3,706	3,557
Vitamin C (mg)	85	87
Thiamine (mg)	1.08	.85
Riboflavin (mg)	1.77	1.47
Niacin (N.E)	28	21

1. Mean values do not include supplements.

Nutrition Canada, 1973

Intakes of thiamin and calcium for males and females did not meet recommended intakes[15]. Dairy products were the main source of calcium in the diets of the elderly.

Nutrition Canada[16] evaluated the quality of diet by classifying nutrient intakes into three levels: inadequate, less-than-adequate, and adequate.

"Inadequate intakes" are considered to be those intakes that are below the minimum requirements of a nutrient. "Less-than-adequate" intakes are above the minimum requirement but below the desirable amount of intake for a given nutrient. "Adequate" intakes provide a desirable margin of safety in meeting the body's need of a nutrient. The percentages of elderly men and women with "inadequate" intakes of nutrients are presented in Table 2.2.

Table 2.2: Percentages of Canadian males and females with "inadequate" intakes of nutrients

Nutrient	Male (%)	Female (%)
Protein	7.1	14.5
Iron	4.9	8.4
Calcium	9.9	20.0
Vitamin A	23.1	32.1
Vitamin C	4.0	1.9
Thiamine	10.7	14.5
Riboflavin	4.3	14.8
Niacin	1.6	4.7

Nutrition Canada, 1973.

Murray[51] assessed the results of Nutrition Canada[16], and concluded that non-institutionalized mobile elderly showed no gross nutritional deficiences. He further concluded that many elderly were obese, especially females. Also iron, calcium and vitamin A were the nutrients most often low in the diet.

The Saskatchewan results of the Nutrition Canada[16] survey indicated

that the elderly, particularly males, were the group most vulnerable to nutritional deficiencies. The elderly had the lowest calorie intake of all age groups in Saskatchewan, and the highest percentage of overweight people. Calcium and thiamine intakes were below recommended levels. Vitamin A and riboflavin intakes were the lowest of all age groups studied. Calorie and nutrient intakes were similar for the national and provincial samples of elderly people except that Saskatchewan females consumed less calories, calcium and vitamin C. Saskatchewan males consumed more vitamin A and less vitamin C than the national sample of males.

Monagle[a] examined dietary intakes of 780 Canadians, 60 years of age and over. Results indicated that the patterns of food intake remained constant with increasing age, but that smaller amounts of each food were consumed. Mean caloric and nutrient intakes for males and females are presented in Table 2.3.

Monagle reported that several factors affected dietary intakes. In all age groups, males had better nutrient intakes except for the 60 to 70 year old group in which females consumed better diets. High income groups had better nutrient intakes than low income groups. Although single women tended to have better nutrient intakes than single men, those single men living with relatives consumed better diets. Subjects without formal education had the poorest dietary intakes while subjects with high school education tended to consume the best diets.

Reid,[47] in a survey of 50 non-institutionalized elderly living in Guelph, Ontario, found that only ten percent of the subjects consumed diets that met the 1964 Canadian recommended nutrient intakes[10]. Mean caloric and nutrient intakes for elderly males and females are presented in Table 2.4.

[a]Monagle, J. E., personal communication.

Table 2.3: Mean caloric and nutrient intakes for males and females over 60 years of age

Kilocalories and Nutrients	Male	Female
Kilocalories	1,872	1,461
Protein (g)	65.7	53.3
Fat (g)	81.8	60.0
Calcium (mg)	746	554
Iron (mg)	11.5	9
Vitamin A (I.U.)	8,496	6,860
Vitamin C (mg)	62	63
Thiamine (mg)	.99	.77
Riboflavin (mg)	1.44	1.12
Niacin (mg)	12	9.8

Monagle, J. E., personal communication.

Intakes of calories, vitamin A, and vitamin C were most often deficient in the diet. As calorie consumption increased, subjects were more likely to have nutrient intakes exceeding 67 percent of recommended allowances.

Supplementation of the diet did not appear to be effective. Reid found that only four of the 12 subjects consuming supplements raised deficient nutrient intakes to recommended levels.

Table 2.4: Mean caloric and nutrient intakes for elderly males and females, and percentages of diets below recommended intakes

Kilocalories and Nutrients	Mean Intakes		Percent of Diets	
	Males	Female	<100% RDA	<67% RDA
Kilocalories	1,776 ± 479[1]	1,542 ± 430	38	20
Protein (g)	69 ± 26	55 ± 14	18	2
Fat (g)	68 ± 23	61 ± 21	--	
Calcium (mg)	673 ± 314	636 ± 253	32	2
Iron (mg)	11.7 ± 6.3	8.8 ± 2.2	8	2
Vitamin A (I.U.)	5,943 ±4,447	4,737 ±3,578	26	14
Vitamin C (mg)	81 ± 46	70 ± 39	8	8
Thiamine (mg)	1.05± .41	.87± .21	34	-
Riboflavin (mg)	1.72± .6	1.37± .5	44	-
Niacin (mg)	14.2 ± 4.0	12.6 ± 3.7	8	-

1. Standard deviations

Reid, D. L., 1975.

A relationship was found between income and diet. Subjects with greater financial resources consumed a wider variety of foods and consumed nutritionally superior diets.

Johnson[36] surveyed 74 homebound individuals who were unable to prepare their own food. Results from dietary histories showed that only 15 percent

of the subjects met the recommended allowances[10] for calories and eight nutrients. Greater than two-thirds of the group were below the recommended calorie intake for people of their age and weight. Forty-five percent did not meet vitamin A recommendations, 39 percent did not meet recommendations for iron, and 31 percent were below recommendations for vitamin C. A relationship between age and nutrient intake was found. Subjects over 80 years of age were more likely to consume diets deficient in total nutrient intake than subjects under 80. Daily mean caloric and nutrient intakes for elderly males and females are presented in Table 2.5.

Miles[46] examined three-day food records of 106 elderly subjects in a normal care home for the aged in Guelph, Ontario. Dietary intakes of all subjects exceeded recommendations except for the 65 to 74 year old males who were low in calcium. Twenty-three subjects consumed supplements but only one individual raised the inadequate intake of a nutrient to recommended levels of intake. Mean caloric and nutrient intakes for elderly males and females are presented in Table 2.6.

Leichter[41] surveyed 104 single elderly and 23 couples, using the 24-hour dietary recall method. Mean caloric and nutrient intakes for single elderly men and women are presented in Table 2.7.

Mean intakes of individual nutrients were comparable to or greater than recommended allowances[15] for both single men and women[41]. Mean caloric intakes were below the levels recommended by the Canadian Dietary Standard[15]. Single men consumed greater amounts of calcium as compared to married men. Single women consumed more calories, calcium, thiamine, and riboflavin than married women. The percentages of individuals with "inadequate" intakes, according to Nutrition Canada[16] standards are presented in Table 2.8.

Table 2.5: Average daily caloric and nutrient intakes for a group of elderly males and females and percentages of diets below recommended intakes

Kilocalories and Nutrients	Average Daily Intake	Percent of Diet	
		<100% R.D.A.	<67% R.D.A.
Kilocalories	1,584	67	20
Protein (g)	60.7	18	2
Calcium (mg)	685	28	12
Iron (mg)	7.5	39	12
Vitamin A (I.U.)	6,245	45	23
Vitamin C (mg)	42.8	31	19
Thiamine (mg)	.7	25	7
Riboflavin (mg)	1.3	19	4
Niacin (mg)	9.1	7	4

Johnson, B., and Feniak, E., 1965.

Table 2.6: Mean caloric and nutrient intakes for elderly males and females

Kilocalories and Nutrients	Males	Females
Kilocalories	2,091 ± 365	1,989 ± 389
Protein (g)	74 ± 14.5	68 ± 14.9
Fat (g)	89 ± 18	83 ± 20.5
Calcium (mg)	816 ± 323	817 ± 348
Iron (mg)	11.7 ± 2.49	10.6 ± 2.33
Vitamin A (I.U.)	5,607 ±1,503	5,437 ±1,864
Vitamin C (mg)	78 ± 30.8	94 ± 38.9
Thiamine (mg)	1.14± .29	1.06± .23
Riboflavin (mg)	1.99± .53	2.02± .61
Niacin (mg)	12.96± 4.06	12.31± 3.07

1. Standard deviations

Miles, E., and Chapple, D. J., 1975.

Table 2.7: Mean caloric and nutrient intakes for single elderly men and women

Kilocalories and Nutrients	Male	Female
Kilocalories	1,867 ± 648[1]	1,449 ± 495
Protein (g)	73 ± 33	62 ± 38
Fat (g)	81 ± 44	60 ± 25
Calcium (mg)	859 ± 538	671 ± 381
Iron (mg)	11.1 ± 6.9	9.4 ± 5.6
Vitamin A (I.U.)	5,150 ±4,476	5,320 ±5,295
Vitamin C (mg)	65 ± 61	87 ± 68
Niacin (mg)	15 ± 9.1	12.1 ± 5.6
Riboflavin (mg)	1.7 ± .9	1.8 ± 1.6
Thiamine (mg)	1.0 ± 5	.9 ± .5

1. Standard deviations

Leichter, J., et al., 1978

Table 2.8: Percentages of single elderly males and females with "inadequate" intakes according to standards developed by Nutrition Canada[16]

Nutrient	Male (%)	Female (%)
Protein	4	7
Calcium	10	16
Iron	18	24
Thiamine	14	16
Riboflavin	4	7
Niacin	28	33
Vitamin C	16	7

Leichter, J., et al., 1978

Thirty-five percent of all subjects were on special diets of which about one-third were diabetic diets. Fifteen percent of all subjects consumed vitamin supplements. The effect of either factor on nutrient intake was not reported.

Several Canadian surveys[a,16,36,56] have indicated that elderly males and females are not meeting recommended intakes[15] for calcium and thiamine. Males and females in other surveys[41,46] did not meet recommended intakes[15] for thiamine. Intakes of calcium and thiamine are consistently inadequate in the diet of elderly Canadians.

2.3 Dietary intake surveys of the elderly in other countries

Major nutritional surveys of the elderly have been conducted in foreign countries, especially in the United States and Britain. These surveys are of interest as they indicate the different cultural and social

[a]Monagle, J. E., personal communication.

factors that may influence the quality of the diet of the elderly.

The Department of Health and Social Security[13] in the United Kingdom conducted a major nutrition survey of the elderly in 1973. Dietary records were kept by 879 men and women over the age of 65. A broad range of social and economic variables was examined in relation to dietary intakes. Results indicated that quality of diet was affected by age. In both sexes, 65 to 75 year olds consumed better diets than those over 75. Mode of living affected the nutrient intakes of single men over the age of 75. This group had poorer dietary intakes than those men living with spouses or relatives. The average intake of nearly all nutrients was close to recommended intakes[14] but a wide range of intakes was reported. The panel suggested some malnutrition does exist in the elderly population. Mean calorie and nutrient intakes for elderly males and females are presented in Table 2.9.

The Ten State Nutrition Survey[66] in the United States found that persons over 60 years of age were at nutritional risk. A wide range of intakes was observed for most nutrients and many subjects consumed less than survey standards. The Ten-State standards for calorie and dietary intakes approximated those values set in the 1968 American Recommended Dietary Allowances[24]. Calorie intakes did not meet survey standards for males and females. Iron and protein intakes were low for women. The survey was unable to find any relationships between adequacy of diet and income. Mean calorie and nutrient intakes for males and females are presented in Table 2.10.

Table 2.9: Mean caloric and nutrient intakes for elderly males and females according to age

Kilocalories and Nutrients	Males		Females	
	65 - 74	75 and over	65 - 74	75 and over
Kilocalories	2,344	2,103	1,787	1,628
Protein (g)	74.6	67.6	59.2	53.6
Calcium (mg)	910	880	800	730
Iron (mg)	12.2	10.9	9.4	8.5
Vitamin A (I.U.)	3,790	3,650	3,420	2,960
Vitamin C (mg)	43	38	40	34
Thiamine (mg)	1.1	.9	.8	.7
Riboflavin (mg)	1.6	1.4	1.3	1.1

Department of Health and Social Security, 1972.

Table 2.10: Mean caloric and nutrient intakes for males and females

Kilocalories and Nutrients	Male	Female
Kilocalories	1949	1412
Protein (g)	80.1	59.5
Calcium (mg)	736	568
Iron (mg)	13.1	9.6
Vitamin A (I.U.)	4979	5172
Vitamin C (mg)	59	67
Thiamine (mg)	1.14	.86
Riboflavin (mg)	1.76	1.40
Niacin (N.E.)	19.06	14.72

Ten State Nutrition Survey, 1972.

The San Mateo[63] nutrition survey was a 14 year longitudinal study initiated in 1948. Nutrient intakes of 577 subjects over the age of 50 were recorded using a seven-day food record and a dietary history interview. During the study, four separate dietary surveyswere administered. Information on nutrient intakes, disabilities and illnesses were obtained for 141 of the 577 original subjects at the completion of the study.

Men and women significantly reduced their food intake after 75 years of age. Calorie consumption decreased with increasing age, but intakes of

animal protein remained constant with age. Mean intakes were found to be adequate for most nutrients although some subjects had intakes below two-thirds of the recommended levels[24]. Individual intakes did not reveal a consistent trend over the four separate surveys. Percentages of 141 subjects with nutrient intakes below two-thirds of recommendations[24] are presented in Table 2.11.

Table 2.11: Average percentage of diets below two-thirds of recommended levels over four surveys for 141 elderly subjects according to sex.

Calories and Nutrients	Male (%)	Female (%)
Calories	9	9
Protein	7	8
Calcium	16	41
Iron	2	6
Vitamin A	16	23
Vitamin C	18	19
Thiamin	7	5
Riboflavin	5	10
Niacin	52	60

Steinkamp, R. C., et al., 1965.

Eighty of the 141 subjects examined in the final survey consumed vitamin and mineral supplements. Twenty-seven of these individuals had adequate diets and did not need supplementation.

The American[63,66] surveys revealed that calcium intakes of the elderly

did not meet recommended intakes. Thiamine intakes were inadequate in American[66] and British[13] surveys. These results are similar to Canadian surveys and suggest that dietary inadequacies may originate from common nutritional problems of the elderly in all countries.

2.4 Nutrition problems of the elderly

Natural changes occurring with age may interfere with food intake[33]. The loss of teeth and diminishing senses of taste and smell may inhibit the consumption of an adequate diet. Sensory losses may make food unattractive and monotonous. Loss of teeth or poorly fitting dentures may lead to a diet high in carbohydrate and low in protein.

Processes that are basic to the digestion and absorption of nutrients are impaired during aging[33]. These processes include atrophy of the salivary glands, a reduction in the secretory ability of the digestive glands, and decreased production and release of bile from the liver. These changes may directly affect nutritional requirements for specific nutrients.

A gradual reduction of basal metabolism occurs with increasing age[59]. As well, McGandy[45] has reported a tendency for people to reduce physical activity as they become older. These two factors indicate a decreased need for calories for the elderly. Results of several studies[a,5,13,60,63] have indicated that overall calorie consumption tends to decrease with increasing age. Macleod[43] suggested that differences in energy intake attributed to age and sex may be caused by differing body sizes and composition. Macleod, using a seven-day dietary record, measured intakes of energy, protein, sucrose, carbohydrate, and fat for 77 elderly men and 187 elderly women living at home. All subjects were found to have decreased their energy intakes with increasing age. Men consumed more energy than women, but

[a]Monagle, J. E., personal communication.

when intakes were expressed on the basis of lean body mass, these apparent differences in energy consumption disappeared.

A failure to adequately decrease calorie consumption with increasing age often leads to obesity[33]. Nutrition Canada[16] found that the elderly had the highest proportion of obese subjects in all age groups.

Nutrition of the elderly may be affected by increasing disabilities that occur with increasing age[23]. Akhtar[2] surveyed a random sample of 808 people, 65 years of age and older. Results indicated that the occurrence of disability increased from 12 percent for those aged 65 to 69, to more than 80 percent for those over 85 years of age. Akhtar defined disability as "the inability to live at home without help". According to his definition disability includes abnormalities in one or more of five areas; mobility, domestic care, self-care, psychiatric care, and continence.

In 1962, Stanton[60] conducted a dietary study of 60 women aged 70 to 94 years who were living alone. Seven years later a follow-up study was carried out on 22 of the original 60 subjects. A comparison of dietary intakes from both studies indicated that nutrient intakes for those subjects who had retained good health did not change over the seven year period. Subjects whose health had declined showed a 17 percent decrease in calorie intake and a 20 percent decrease in protein intake. During their eighth decade a large proportion of the elderly are affected by increasing physical and mental disabilities. Stanton suggests that these disabilities have a major influence on nutrient intake.

Caird,[8] using a seven-day dietary history and a 24 hour recall, interviewed 264 old people living at home. Indices of malnutrition were constructed from the number of nutrients taken in amounts less than

recommended levels. One point was given for each nutrient that was below a determined level. High scores were related to the following factors: decreasing amounts spent on food per week, physical disability, and the taking of seven or fewer hot meals per week.

Exton-Smith[22] compared nutrient intakes of three groups of people: active elderly, housebound elderly, and residents of a nursing home. Active elderly were found to have the highest nutrient intakes while the housebound elderly had the lowest. Exton-Smith did not observe differences between nutrient intakes of housebound elderly who could or could not cook for themselves. For all subjects, impairment in health was significantly correlated with a decrease in nutrient intakes. Exton-Smith suggested that a decline in nutrient intakes with advancing age may be a consequence of underlying physical illness.

One-fifth of all elderly in Canada live alone[54]. These single elderly are highly susceptible to malnutrition. Keys[38] suggested that the most extreme cases of malnutrition are often found in the diets of elderly recluses and alcoholics. The older person living alone often neglects nutritional quality by selecting foods based on convenience and ease of cooking. Pelcovits[53] suggested that there is a link between isolation and nutrition. Lonely people will not prepare proper meals for themselves. Many elderly people are lonely because they live alone and eat alone[64]. Food is a medium of socialization and not just a physiological necessity[70].

Durnin[21] suggested that elderly men and women living alone are more likely to suffer from nutrient deficiencies than the general population. Possible reasons are that cooking may be too much trouble, and that inadequate income may preclude purchase of proper foods. In Canada,

individuals aged 70 years and over received the lowest income of all age groups greater than 20 years of age[62]. The next lowest income receiving group was those aged 65 to 69 years.

Davidson[12] surveyed 104 elderly people, one-half of whom lived alone. A scale of "social isolation" was constructed to determine if nutrient intakes were related to the following factors; living and eating with others; opportunities for social contacts with others; and the relative ease or difficulty in purchasing, cooking and chewing food. The most isolated subjects consumed a lesser variety of foods and were more overweight than those subjects who were least isolated. Mean daily intakes were lowest for the most isolated group as compared to the least isolated group for all nutrients except iron.

Single people often lose touch with their need for food. LeBovit[40] compared dietary intakes of elderly subjects living alone or in couples. The results indicated that for single people poor diets were more often caused by lack of interest in eating. Williams[71] examined 297 patients living alone or in couples and found that 82 percent of all those with inadequate diets lived by themselves. Many of these subjects showed a lack of initiative in preparing food.

Monagle[47] suggested that subjects living alone or subjects who are financially or physically disadvantaged could benefit from special services that were designed to assist in problems of feeding the elderly beyond normal household practices. Lunch club, day centres, or restaurants can provide meals for those elderly who are fully ambulatory and capable of self-care except for the preparation of a hot meal. Transportation service to a meal center or Meals on Wheels delivery can assist the elderly subject

who is not fully ambulatory. Homemaking services can provide daily assistance with personal care and food preparation for subjects who are not fully independent but can remain at home. Senior citizen homes provide total care including meal service for subjects who are unable to maintain their independence.

2.5 Dietary surveys comparing elderly living at home and in institutions

In 1977, eight percent of the elderly in Canada lived in institutions[54]. Rowe[57] suggested that families often consider nursing homes as the only means of coping with the problems presented by the elderly members of the family. The elderly themselves prefer to live at home. Two factors that may contribute to this preference are the loss of privacy and the impersonality of institutional life.

There are many alternatives to institutionalization[28]. Day care, home health aides, and homemaking services can support the elderly in remaining at home. Independent elderly individuals need more help from outside the home as they grow older. Hall,[28] reporting on the Prince Albert Health Region, found that 40 percent of those over 80 years of age need at least one supportive service. Often elderly may be institutionalized due to a lack of alternative community services. Hall found that of 167 individuals on the waiting lists for institutions in the Prince Albert Health Region, only 38 required that degree of care. Hall suggested that improving community services would stabilize home situations and delay the need for intensive care in an institutional setting. Jansen[35] conducted a survey of 46 women in nursing homes and 24 women in private homes. Food intakes were measured on three consecutive days. Women in private homes consumed 55 grams of protein which was significantly ($p \leq 0.05$) greater than the

46.5 grams per day consumed by nursing home residents. Protein intake was affected by age. The 76 to 85 year old group consumed significantly less ($p \leq 0.05$) protein than the 62 to 75 year olds. Income and education had no effect on protein intake. Calorie and iron intakes did not differ significantly between home-living and institutionalized subjects. The mean caloric intake of all subjects was 1,343 calories per day. Income, education, and age did not affect calorie intake. The mean iron intake for all subjects was 16 milligrams per day. All subjects decreased their iron intake by 0.1 milligram with each year of increasing age. Income and education had no effect on iron intakes.

Harrill[31] conducted a survey on 46 women in nursing homes and 24 women in private homes. Nutrient intakes were considered adequate if they met or exceeded 67 percent of recommended intakes. Harrill suggested that full recommendations generally include a safety factor and may not accurately reflect average physiological requirements. Mean caloric and nutrient intakes for elderly females are presented in Table 2.12.

Dietary intakes were examined in relation to residence, age, income, education, and supplementation. Calorie and vitamin contents of the food consumed by residents in nursing homes were not found to be significantly different from those of women living at home. Age did not appear to affect caloric consumption, but vitamin intakes by the 86 to 99 year olds were significantly lower than those of 62 to 75 years. Harrill found that low income groups consumed significantly less niacin and vitamin C than median income groups. Subjects with more than twelve years education consumed significantly more niacin than those with less than eight years.

Table 2.12: Mean caloric and nutrient intakes for elderly females and percentages of diets below two-thirds of recommended levels.

Kilocalories and Nutrients	Females	Percent of Diets <2/3 R.D.A.
Kilocalories	1,343 ± 37	30
Vitamin A (I.U.)	4,338 ±266	21
Vitamin C (mg)	83 ± 6	13
Thiamine (mg)	.72± .03	47
Riboflavin (mg)	1.19± .05	9
Niacin (mg)	9.3 ± .5	43

Harrill, I., and Cervone, N., 1977.

Bransby[5] surveyed the dietary intakes of 103 elderly subjects living alone or as married couples, and 16 subjects residing in nursing homes. Nursing home subjects consumed an average of 400 to 500 more calories per day than those living in their own homes. Bransby suggested that this difference in caloric intake may be due to the following factors; subjects living in their own homes had the difficulty of buying and cooking their own food, while those in institutions had their food prepared; and those in institutions probably were less active than those living at home. Mean daily intakes of calories and nine nutrients are presented in Table 2.13.

Table 2.13: Mean caloric and nutrient intakes for elderly males and females according to residence

Kilocalories and Nutrients	Male		Female	
	Home	Institution	Home	Institution
Kilocalories	2,096	2,536	1,746	2,138
Protein (g)	71	70	57	60
Fat (g)	85	108	74	103
Calcium (mg)	900	900	800	700
Iron (mg)	14	12	10	10
Vitamin A (I.U.)	2,340	2,339	2,115	6,020
Vitamin C (mg)	21	26	21	38
Thiamine (mg)	1.1	1.1	.9	.9
Riboflavin (mg)	1.1	-	1.0	-
Niacin (mg)	9	-	7	-

Bransby, E. R., and Osbourne, B., 1953

Women in nursing homes consumed greater amounts of calories, fat, vitamin A, and vitamin C than women in private homes. Men in institutions consumed greater amounts of calories, fat, and vitamin C than men in private homes. Dietary intakes of subjects living at home were affected by age. Men decreased their calorie and vitamin C intakes with increasing age. Women decreased their consumption of calories and all vitamins except

vitamin C with increasing age. Bransby would not evaluate the quality of the dietary intakes for the groups studied because at the time of the study, little data were available for the elderly.

Clarke[11] conducted a survey on 98 elderly subjects living independently and 99 residents of nursing homes. Dietary intakes were evaluated by giving one point for each nutrient that met or exceeded two-thirds of the 1968 recommended[24] allowance for that nutrient. An individual's score could range from zero to eight. Calories were calculated but they were not included in the nutritional score.

Nutritional scores did not differ according to residence, sex, or age. Subjects living in nursing homes decreased their nutritional scores as their level of mobility decreased. Clarke suggested that for independent elderly, health and mobility problems were not serious enough to affect nutrient intakes or their independence. Forty-nine subjects consumed dietary supplements and 12 of these subjects improved their nutritional scores.

Brown[6] conducted a survey on 23 elderly subjects living independently, and 20 residents of a private nursing home. Nutrient and caloric intakes were considered adequate if they exceeded 67 percent of recommended allowances. Women living independently consumed significantly greater ($p \leq 0.05$) amounts of calories and nutrients except for calcium and riboflavin. Men living independently consumed significantly greater amounts of calories and all nutrients except for calcium and vitamin A. Mean intakes for calories and nutrients are presented in Table 2.14.

Table 2.14: Mean caloric and nutrient intakes of elderly males and females according to residence

Kilocalories and Nutrients	Males		Females	
	Home	Institution	Home	Institution
Kilocalories	2,166	1,366	1,633	1,291
Protein (g)	72.6	53.6	60.3	48.7
Calcium (mg)	665	614	570	641
Iron (mg)	14.7	9.1	10.5	8.4
Vitamin A (I.U.)	6,249	3,591	5,439	3,252
Vitamin C (mg)	161	67	122	58
Thiamine (mg)	1.22	.78	.96	.69
Riboflavin (mg)	1.45	1.22	1.28	1.20
Niacin (mg)	15.5	9.8	12.2	8.2

Brown, P. T., et al., 1977

Men and women living at home consumed diets with adequate calories, and all nutrients exceeded 67 percent of recommended allowances. Dietary intakes of those living in institutions were satisfactory except for calories for the men and women, and niacin and thiamine for the men. The meals provided by the institution contained adequate amounts of all nutrients except calories.

Leighton[42] suggested that in institutions the nutritive value of the

diet ultimately depends not only on the amount of food actually consumed by residents, but also on personal factors unrelated to management. Although nursing homes may serve adequate diets, the amounts consumed by individuals may not meet recommended allowances[32]. The results of these studies[5,6,11,31,35] do not indicate that the institutionalized elderly for whom all meals are provided consume better diets than those living at home. Brown[6] found that independents consumed better diets than institutionalized subjects. Clarke[11] and Harrill[31] did not find any differences in the quality of diet for subjects living at home or in institutions, while Bransby[5] and Jansen[35] found differences in some nutrients but not others for subjects living at home or in institutions. The results of these studies[5,6,11,31,35] indicate that the elderly can properly meet their nutritional needs at home. For those elderly who are not fully capable of self-care, Meals on Wheels programs may assist in meeting their nutritional needs.

2.6 Dietary intake surveys of elderly subjects receiving Meals on Wheels

Meals on Wheels programs provide cooked meals for people who are not fully capable of preparing their own food. Meals are usually delivered by volunteers who often provide the only social contact of the day for the recipients in the program[30]. The first Meals on Wheels project was initiated in England[27] in 1939. The program was designed to provide one hot meal per day to the aged and to mothers unable to prepare their own food. The service proved extremely successful and as a result, similar programs were started throughout the world. Meals on Wheels in Saskatoon,[58,68] Saskatchewan, originated with the Anglican Church in 1967, but since 1970 has been the responsibility of the Family Service Bureau. Clients are usually the handicapped and elderly people. Referrals to the program are made by doctors, hospitals, agencies,

families or friends.

Moore[48] conducted a survey on the dietary intakes of two groups of independent elderly living alone in order to determine the effectiveness of a Meals on Wheels program. Dietary intakes of one group were determined before and after the meals delivery program, while the other was used as a control group. Mean caloric and nutrient intakes for five males and seven females after ten weeks of meals delivery are presented in Table 2.15.

Table 2.15: Mean caloric and nutrient intakes for males and females after ten weeks of meals delivery

Kilocalories and Nutrients	Male	Female
Kilocalories	1,682	1,561
Protein (g)	55.1	61.3
Fat (g)	67	65
Calcium (mg)	690	780
Iron (mg)	9.5	9.3
Vitamin A (I.U.)	4,097	5,112
Vitamin C (mg)	60	96
Thiamine (mg)	.89	.91
Riboflavin (mg)	1.27	1.44
Niacin (mg)	11.7	10.4

Moore, C. N., 1966

After ten weeks of the program, the mean level of intakes of iron, niacin, and vitamin C for the experimental group was found to be significantly higher ($p \leq 0.05$) than those prior to Meals on Wheels delivery. The percentage of diets deficient in iron decreased from 38 to zero percent. Diets deficient in vitamin C were reduced from 44 to zero percent, and protein deficiencies decreased from 31 to eight percent. The percentage of deficient diets decreased for calories and nutrients in all cases except calcium. Diets deficient in calcium increased from 13 to 50 percent.

Moore suggested that Meals on Wheels permitted some of the subjects to live at home longer than their health would have otherwise permitted. An analysis of the nutrient content of the food provided by Meals on Wheels indicated that except for calcium and riboflavin Meals on Wheels provided the major proportion of the total daily calorie and nutrient intake for all subjects in the program. The mean percentages of caloric and nutrient intakes provided by the noon meal for subjects receiving Meals on Wheels are presented in Table 2.16.

Stanton[61] examined the nutritional contribution made by Meals on Wheels and luncheon clubs to the total diet of 107 elderly people. The contribution provided by these supplementary meals to the total dietary intakes of subjects was due to one or more of four factors; the number of meals supplied to subjects in a week; the nutritive value of the meals supplied; the actual amount of the meal consumed and the nutritive value of the remainder of the diet.

Four subjects received Meals on Wheels for less than five days in a week. Stanton suggested that less than four Meals on Wheels per week do not provide a significant contribution to the total diet.

The majority of subjects received Meals on Wheels for five days a week. For these subjects, the nutrient content of the weekend diet when meals were not provided was also investigated. Results indicated that a seven day program would not markedly improve the nutritive value of the diet.

Table 2.16: The mean percentages of caloric and nutrient intakes provided by the noon meal for subjects receiving Meals on Wheels

Kilocalories and Nutrients	Mean Percentage of Daily Intake in Noon Meal
Kilocalories	51
Protein	59
Fat	55
Calcium	35
Iron	68
Vitamin A	72
Vitamin C	90
Thiamine	58
Riboflavin	46
Niacin	76

Moore, C. N., 1966

All meals were supplied by two luncheon clubs and six Meals on Wheels kitchens. A large variance was found in the nutritive value of the meals supplied by these centers. The highest values reported for protein, iron, and vitamin C were twice those of the lowest values. These large differences were caused by unequal portion sizes, methods by which certain foods were served, and differing selection of foods.

Actual food intakes were lower than the amount of food that was provided

as nearly 80 percent of recipients wasted part of their meal. Reasons given for leaving food were: "too large a portion", "too hard to chew", "unpalatable", "poorly cooked", "cold", and "indigestible". Several subjects did not consume their meals at the time of delivery but stored their food until later in the day.

The nutritive importance of Meals on Wheels and club meals increased as the quality of the remainder of the diet decreased. Stanton,[61] in assessing the total diet of the subjects, found that one-quarter of the subjects relied on supplementary meals for a large portion of their animal protein, iron, calcium, and B complex vitamins. Twenty-five people consumed fruit and vegetables only when they were part of the Meals on Wheels program. For this group, the service was of major importance to their nutritive well-being.

A review of a Meals on Wheels project in Philadelphia indicated that the overall health of subjects improved during the time of service. Fewer sedatives were required for sleep, and appetite and eating habits improved. Some patients were able to leave hospital early, and Haddad[27] suggested that this type of program encourages independent living at home.

Many people have no visitors other than Meals on Wheels volunteers[30]. Meals on Wheels programs not only fill the nutritional needs of many older people but can meet their social and emotional needs as well[37].

3. MATERIALS AND METHODS

3.1 Description of elderly subjects

The survey was designed to assess the nutrient intakes of elderly people in Saskatoon, Saskatchewan. People over the age of 65 are considered to be elderly as this is the customary age of retirement[65] and the age of eligibility for Old Age Security[19].

3.2 Description of participants

3.2.1 Sources of participants

Samples were drawn from three groups; the Sherbrooke Community Center, the Alliance of Youth and the Elderly program, and the Meals on Wheels program. Fifty subjects were chosen from the Sherbrooke Community Center, 46 subjects from the Alliance of Youth and the Elderly program, and 24 subjects were selected from the Meals on Wheels program. A larger number of subjects was not available from the Meals on Wheels program resulting in unequal sample sizes. The total sample consisted of 120 people. Subjects from the Meals on Wheels and the Alliance of Youth and the Elderly program were single and living alone. Subjects were defined as living alone if they did not share their living quarters with other occupants.

3.2.2 Description of sources

Sherbrooke Community Center is a Level-Three institution in Saskatoon with 326 beds. Level-Three institutions are defined[39] as those institutions providing intensive personal nursing care. Patients are bedfast or are in advanced stages of chronic illness. The nutritional needs of the residents

are the responsibility of a full-time dietitian.

The Alliance of Youth and the Elderly is an organization that assists the elderly in maintaining their homes. The Alliance is funded through provincial government sources and must meet 20 percent of their operating budget by charging fees.[a] Services to elderly clients do not include meal preparation or nutritional counselling.

Meals on Wheels in Saskatoon brings one hot meal each weekday to clients who are unable to prepare food for themselves. The program is coordinated through the Family Service Bureau,[58] and volunteers deliver meals prepared by the City and University Hospitals. The program is subsidized by the provincial government and the Saskatoon United Appeal.

3.2.3 Preliminary approach

Early in 1977, permission was obtained from the director of the Sherbrooke Community Center to interview all patients. A preparatory questionnaire was tested and results indicated that not all patients were capable of responding to questions about themselves. The head nurse and dietitican were asked to compile a list of those patients who in their judgement were capable of completing an interview. This resulting list comprised 120 patients and formed the basis for the selection of all subjects from the Sherbrooke Community Center.

Permission was obtained from the board of directors of the Alliance of Youth and the Elderly to interview all members on file. The file contained 1400 names of members and formed the basis of selection for all subjects from the Alliance of Youth and the Elderly program.

[a]Patricia Roe, Director of Alliance of Youth and the Elderly, personal communication

Permission was obtained from the board of directors of the Family Service Bureau to interview all clients receiving Meals on Wheels. The Bureau contacted all clients and arranged interviews because the names of clients were classed as confidential information. These names could not be released without permission of the clients.

3.3 The questionnaire

3.3.1 Purpose of questionnaire

A questionnaire[16, 34, 66] was constructed (Appendix A) to record dietary intake and the descriptive data of each subject.

3.3.2 Preparation of questionnaire

The questionnaire was pretested on 15 people representative of the samples to be studied. Results of the pretest indicated that the questionnaire was of reasonable length, and that the subjects understood the meaning of all questions.

3.3.3 The twenty-four hour recall of dietary intake

Beal[3] suggested that no method for determining dietary intake is free from errors and limitations. As time and personnel were limited, the 24 hour dietary recall method was selected as the most suitable method for this study. The 24 hour dietary recall method is not appropriate for measuring individual intakes but adequately reflects group intakes[16, 66]. Young[72] suggested that this method is acceptable "when the mean intake of a group of roughly 50 or more persons is desired and when some errors of ten percent can be tolerated". Madden[44] reported that calorie intakes were underestimated but stated that the 24 hour dietary recall is a valid instrument to determine differences in diets between groups. Gersowitz[26] examined the validity of

the method for a group of elderly subjects and found no significant differences between mean actual intakes and mean reported intakes. His results indicated that the 24-hour dietary recall method tended to over-report low intakes and under-report high intakes.

3.3.4 The probe

A probe was constructed in order to cross-check[7] the reported 24 hour intake of each subject, and to stimulate the recall of forgotten food items[1]. Campbell[9] used a menu to probe institutional subjects and knowledge of usual food patterns as a probe for subjects living at home. Results indicated that use of the 24 hour dietary recall method without the probe would have underestimated calorie and nutrient intakes by roughly 30 percent for institutional subjects and 15 percent for subjects living at home.

3.4 Descriptive data

3.4.1 Program

All subjects were members of one of three programs: Meals on Wheels, Alliance of Youth and the Elderly, and the Sherbrooke Community Center.

3.4.2 Name, address and code number

The name and address of each subject was recorded at the interview. A number was assigned to each subject so that all information would remain confidential.

3.4.3 Accommodation

The accommodation scale was designed to indicate different types of living arrangements for those subjects living at home. The different types were; owning a home, renting a home, apartment, hotel, rooming house and other.

3.4.4 Facilities shared

Sharing and non-sharing of subjects' cooking and storage facilities was recorded.

3.4.5 Age

The age of each subject was recorded in years.

3.4.6 Sex

The sex of each subject was recorded.

3.4.7 Marital status

All subjects were single. The marital scale recorded three possible categories of single life; unmarried; widowed; or divorced.

3.4.8 Special diets

The presence or absence of special dietary considerations was recorded. The type of special diet was also recorded.

3.4.9 Supplements

For those subjects consuming supplements, the amounts were recorded directly from the original container. When this was not possible, the brand name and number of tablets consumed were entered in the questionnaire.

3.4.10 Income

Income was divided into six categories in order to record all monies received from employment, bank interest, annuities, old age pension, Canada pension, and any other source. Range I covered all incomes received up to 2499 dollars a year. Range II covered from 2500 to 3999 dollars, range III from 4000 to 5499 dollars, range IV from 5500 to 6999 dollars, range V from

7000 to 8499 dollars, and range VI covered 8500 dollars or more.

3.4.11 Amount of money spent on food per week

Total food expenditure for one week was recorded for each subject.

3.4.12 Education

The number of years of education including trade school was recorded for each subject.

3.4.13 Cooking facilities and storage of perishables

The presence of any electrical or mechanical device that permitted preservation and cooking of food was used as a measure of the adequacy of subjects' cooking and storage facilities.

3.4.14 Mobility

A scale of mobility was devised to reflect the state of health for each individual. Five levels of mobility were established based on methods used by Akhtar[2] and Exton-Smith[22]. The levels were; bedridden, housebound, unable to cook; housebound, able to cook; mobile, unable to purchase food; and mobile, able to purchase food.

3.5 Food models

People as a rule are not easily capable of making an estimate of weights or measures[49]. To assess quantitative data, a collection of coded food models (Appendix B), consisting of glasses, cups, slices, blocks, bowls and spoons, were offered to the subjects. These models were constructed from similar patterns used in the Nutrition Canada[16] and other surveys[49,50,66]. Models did not represent any particular food but were used to assess portion size[16]. Subjects were asked to pick the one that best represented the

amount of each food consumed. Models were measured accurately in fluid ounces and cubic inches[67] to correspond to an intermediate conversion table[50] that changed these scales of measurement into grams[29] for each food consumed.

3.6 The survey

The survey was conducted from September, 1977 to March, 1978. Intakes were examined during the week in order to avoid special meals on weekends[73].

3.6.1 Selection of participants

Participants from Sherbrooke Community Center were selected at random from a list of 120 names. Selected individuals were approached and asked to participate in the study. Advance warning was not given as this was felt to bias the eating pattern on the day of recall[16].

Many individuals refused to take part in the study, and the reasons given were; poor health, lack of time, invasion of privacy, and disinterest. Several subjects were excluded from the study because they had faulty memories or were unable to maintain a coherent conversation. Fifty successful interviews were completed in this group.

Subjects from the Alliance of Youth and the Elderly program were chosen from a file of 1400 registered members. Names were selected at random and individuals were contacted by phone. Subjects were considered eligible for the study if they were single and living alone. A brief explanation was given and their participation was requested. Most individuals who were contacted were willing to participate in the study. Forty-six successful interviews were completed in this group.

Meals on Wheels subjects were selected by the Family Service Bureau from

their list of registered clients. Subjects were considered eligible for the study if they were single, living alone, and receiving five meals a week. The Bureau contacted clients and requested their participation in the study. All clients contacted agreed to be interviewed. Twenty-four successful interviews were completed in the Meals on Wheels group.

3.6.2 The interview

The questionnaire was used to guide the interview, and was designed to establish a rapport with the subject. In accordance with the questionnaire, the interview consisted of two distinct parts. The first part covered questions about descriptive data of the subject and the probe. The second part examined the dietary intake of the subject.

Subjects were asked to list their favourite foods at the start of the interview. This procedure was designed in an attempt to relax and encourage the subjects in answering further questions. The subject's favourite foods and a list of foods most often consumed by elderly people in Saskatchewan[17] were used to form the probe. The first part of the interview was completed by recording the descriptive data of each subject.

For the dietary recall, the subjects were asked to remember all foods consumed between midnight of the previous day and the midnight prior to that. If the subjects encountered difficulty in remembering foods consumed, an attempt was made to relate meals to activities of the previous day[73]. When all individual food items had been recorded, the probe was read to the subjects in order to stimulate recall of any forgotten foods. After this validation of dietary recall, the subjects were asked to choose the food model (Appendix B) which best represented the amount of each food item consumed. If the diet prior to the day of interview was not typical of

usual intake, the meeting was rescheduled. All successful interviews were marked complete.

3.7 Analysis of data

3.7.1 Evaluation of data

The program for computer analysis of the questionnaire data was prepared with the assistance of the Academic Computing Services and the Department of Mathematics. Data from the 24-hour recall was coded to correspond to the Handbook of The Nutritional Contents of Foods,[69] U.S.D.A., Number eight. Most variables were coded from one to six in preparation for statistical analysis. Age and education were coded in years and in categories. There were three categories of age; 65 to 74, 75 to 84 and 85 or more. Education was broken into three categories; zero to seven years, eight to 12 years and 12 years or more. Mobility was broken into two major categories for the analysis of variance. Bedridden, and housebound, unable to cook formed one division. Housebound, able to cook; mobile, unable to purchase food; and mobile, able to purchase food formed the other division.

3.7.2 Statistical analysis

Calories and nutrients were analysed by analysis of variance[52]. The "Least Significant Difference" and "Student-Neuman-Keuls" multiple range tests were used to test for significant differences ($P \leq 0.05$) between the groups. Sixty-seven percent of the recommended intakes of each nutrient was used as the baseline to determine an adequate intake of a given nutrient[11,31,36,40,63]. Ninety-five percent confidence intervals[4] of calorie and nutrient intakes were used to analyse adequacy of intakes as compared to 1976 Canadian recommended dietary intakes[15].

Recommendations for calories were based on the needs of a 70 kilogram

man and a 56 kilogram woman both aged 65 and over, engaging in the level of activity considered typical for their age group[15].

4. RESULTS

4.1 Statistical parameters of the survey

In order to make meaningful comparisons of the nutrient intakes of the subjects examined in this survey, the statistical parameters of the sample group were analysed in order to ascertain the degree to which they approximate those of the elderly population in Canada. Accordingly, all subjects were analysed on the basis of several different categories of socio-economic and demographic characteristics. These categories included sex, age, support program, marital status, mobility, education, and special diets.

4.1.1 Distribution of subjects according to sex and age category

All subjects were categorized according to sex and age. The 120 subjects consisted of 33 males and 87 females, and averaged 78.6 (±8.4) years of age. The largest proportion of the subjects (38.4 percent) was between the ages of 75 and 84 (Table 4.1). The smallest proportion of subjects (25.0 percent) was over 85 years of age.

4.1.2 Distribution of subjects according to program and sex

Subjects were not evenly distributed among the three different programs. The largest percentage of the subjects (41.7 percent) was obtained from the Sherbrooke Community Center. The smallest percentage of subjects (20.0 percent) was obtained from the Meals on Wheels program (Table 4.2). Males and females were not distributed evenly among the three programs. Forty four (50.5 percent) of the 87 female subjects and

Table 4.1: Distribution of subjects according to sex and age category

Age Category[1]	Male	Female	Total	Percent
65 - 74	10	34	44	36.6
75 - 84	11	35	46	38.4
≥ 85	12	18	30	25.0
Total	33	87	120	100.0

[1] years

Table 4.2: Distribution of subjects according to program and sex

Program	Male	Female	Total	Percent
Alliance of Youth and the Elderly	2	44	46	38.3
Meals on Wheels	12	12	24	20.0
Sherbrooke Community Center	19	31	50	41.7
Total	33	87	120	100.0

two (6.1 percent) of the 33 male subjects were in the Alliance of Youth and the Elderly.

4.1.3 Distribution of subjects according to marital status and sex

All subjects were classified according to marital status; unmarried, widowed, or divorced. All subjects were single. Eighty-three (69.2 percent) of the subjects were widowed and six (5.0 percent) of the subjects were divorced (Table 4.3). Forty-one (49.4 percent) of the widowed subjects were located in the Alliance of Youth and the Elderly. The largest proportion of the female subjects (85.5 percent) were widowed, while the largest proportion (60.6 percent) of the male subjects were unmarried.

4.1.4 Distribution of subjects according to mobility rating and sex

All subjects were classed according to their level of mobility and sex. Most of the 120 subjects were mobile and none of the subjects were bedridden (Table 4.4). Nine (7.5 percent) subjects were housebound and unable to cook. Of these, eight were in the Sherbrooke Community Center. Fifty-five (63.2 percent) of the 87 females and 19 (57.5 percent) of the 33 males were mobile and able to purchase food.

4.1.5 Distribution of subjects according to years of education and sex

All subjects were classified according to years of education and sex. The 120 subjects attended school for an average of 8.7 (±4.7) years. The majority of subjects (51.7 percent) had between eight and 12 years of education (Table 4.5). Twenty two (18.3 percent) subjects had more than highschool education while five (4.2 percent) subjects did not have any formal education.

Table 4.3: Distribution of subjects according to marital status and sex

Marital Status	Male	Female	Total	Percent
Unmarried	20	11	31	25.8
Widowed	12	71	83	69.2
Divorced	1	5	6	5.0
Total	33	87	120	100.0

Table 4.4: Distribution of subjects according to mobility rating and sex

Mobility Rating	Male	Female	Total	Percent
Bedridden	0	0	0	0
Housebound Unable to Cook	4	5	9	7.5
Housebound Able to Cook	4	13	17	14.2
Mobile Unable to Purchase Food	7	14	21	17.5
Mobile Able to Purchase Food	18	55	73	60.8
Total	33	87	120	100.0

Table 4.5: Distribution of subjects according to years of education and sex

Education[1]	Male	Female	Total	Percent
0 - 7	9	18	27	22.5
8 - 12	16	46	62	51.7
≥ 13	5	17	22	18.3
Missing Cases	3	6	9	7.5
Total	33	87	120	100.0

[1] years

4.1.6 Distribution of subjects according to special diets and sex

All subjects were classified according to sex and the consumption of speical diets. Ten (30.3 percent) of the 33 men, and 31 (35.6 percent) of the 87 females were consuming special diets (Table 4.6). Of the 41 subjects on special diets, 13 (31.7 percent) could not name their diets, ten (24.7 percent) were on diabetic diets, seven (17.0 percent) were on low fat diets, and four (9.8 percent) were on reducing diets.

4.2 Analysis of the 70 subjects from Meals on Wheels and the Alliance of Youth and the Elderly

Data on accommodation, facilities, income, and supplementation were available only for subjects in the Meals on Wheels program and the Alliance of Youth and the Elderly program. Therefore, subjects in these two programs were categorized according to these variables.

4.2.1 Distribution of subjects according to sex and accommodation

Subjects in these two programs were classed according to sex and the type of accommodation (Table 4.7). The 70 subjects consisted of 56 females and 14 males. All subjects in these two groups were living alone. Forty-one (58.6 percent) of the 70 subjects owned their own homes while 24 (34.3 percent) subjects lived in apartments.

4.2.2 Distribution of subjects according to sex and sharing of facilities

Subjects were categorized according to sex and the sharing of their facilities with others. Adequate cooking and storage facilities were available for all but two subjects. One of these two did not have a refrigerator. The other subject lived in a hotel and ate his meals in the

Table 4.6: Distribution of subjects according to special diets and sex

Special Diet	Male	Female	Total	Percent
Yes	10	31	41	34.1
No	23	56	79	65.9
Total	33	87	120	100.0

Table 4.7: Distribution of subjects from Meals on Wheels and the the Alliance of Youth and Elderly according to accommodation and sex

Accommodation	Male	Female	Total	Percent
Own Home	7	34	41	58.6
Rent Home	1	1	2	2.8
Rooming House	1	1	2	2.8
Hotel	1	0	1	1.4
Apartment	4	20	24	34.4
Total	14	56	70	100.0

hotel dining room. Six (8.6 percent) subjects shared and 64 (91.4 percent) subjects did not share their facilities with others (Table 4.8).

4.2.3 Distribution of subjects according to sex and range of income

Subjects were categorized according to their range of income and sex. For subjects living at home, income from all sources was recorded in dollars per year (Table 4.9). Sixty-six (94.3 percent) of the 70 subjects reported their income. All 66 subjects were receiving Old Age Security Payments. Nineteen (27.1 percent) subjects were receiving income from additional sources.

4.2.4 Distribution of subjects according to sex and the consumption of vitamin-mineral supplements

Subjects were classified according to sex and the consumption of vitamin-mineral supplements. Twenty-five subjects consumed supplements, and 23 (92.0 percent) of these were female (Table 4.10).

4.3 Analysis of caloric and nutrient intakes

The adequacy of dietary intakes for a person or a group of people can be assessed by comparing mean daily caloric and nutrient intakes to the 1976 Canadian recommended dietary intakes. Therefore, mean caloric and nutrient intakes were determined for the male and female subjects in each program.

4.3.1 Mean caloric and nutrient intakes for males

Mean daily caloric and nutrient intakes were determined for males in each group (Table 4.11). Mean intakes of calories were marginally low for males in all groups but consumption of calories did not differ significantly

Table 4.8: Distribution of subjects from Meals on Wheels and the Alliance of Youth and the Elderly according to sex and the sharing of facilities

Sharing of Facilities	Male	Female	Total	Percent
Yes	1	5	6	8.6
No	13	51	64	91.4
Total	14	56	70	100.0

Table 4.9: Distribution of subjects from Meals on Wheels and the Alliance of Youth and the Elderly according to range of income and sex

Range of Income[1]	Male	Female	Total	Percent
0 - 2499	0	0	0	0.0
2500 - 3999	8	39	47	67.1
4000 - 5499	2	6	8	11.4
5500 - 6999	4	4	8	11.4
7000 - 8499	0	2	2	2.9
$\geq$ 8500	0	1	1	1.4
Missing Cases	0	4	4	5.8
Total	14	56	70	100.0

[1] income in dollars per year

Table 4.10: Distribution of subjects from Meals on Wheels and the Alliance of Youth and the Elderly according to sex and the consumption of supplements

Consumption of Supplements	Male	Female	Total	Percent
Yes	2	23	25	35.7
No	12	33	45	64.3
Total	14	56	70	100.0

Table 4.11: Distribution of mean caloric and nutrient intakes for males according to program

Kilocalories and Nutrients	Program: Alliance of Youth and the Elderly (n = 2)	Meals on Wheels (n = 12)	Sherbrooke Community Center (n = 19)
Kilocalories	1,940 (1,682 - 2,198)	1,802 (932 - 2,667)	1,912 (578 - 3,178)
Protein (g)	69 (62 - 76)	62 (42 - 100)	75 (30 - 120)
Fat (g)	84 (72 - 97)	72 (44 - 119)	81 (25 - 135)
Calcium (mg)	1,165 (958 - 1,372)	732 (396 - 1,285)	1,174 (67 - 2,118)
Iron (mg)	12 (9 - 15)	11 (5 - 16)	11 (5 - 28)
Vitamin A (I.U.)	5,472 (4,033 - 6,911)	11,038 (4,316 - 19,646)	5,844 (224 - 14,456)
Vitamin C (mg)	142 (65 - 220)	131 (19 - 538)	92 (6 - 258)
Thiamine (mg)	1.0 (.9 - 1.1)	2.0 (.5 - 10.5)	1.0 (.2 - 1.7)
Riboflavin (mg)	2.1 (2.1 - 2.1)	2.3 (.9 - 10.9)	2.0 (.3 - 3.5)
Niacin (mg)	16 (12 - 20)	15 (7 - 55)	11 (3 - 22)

($p \geq 0.05$) from the recommended levels of 2000 calories per day. The mean intake of calcium was low for males in the Meals on Wheels program. However, calcium consumption by the males in the Meals on Wheels program was not significantly lower ($p \leq 0.05$) than present Canadian recommended levels[15] of 800 milligrams per day. Males in the Sherbrooke Community Center consumed significantly less ($p \leq 0.05$) than the recommended level of 18 milligrams of niacin and 1.4 milligrams of thiamine per day. Mean daily intakes for males in all groups exceeded the recommended levels[15] for protein (56 grams), iron (ten milligrams), vitamin A (3,330 international units), riboflavin (1.7 milligrams) and vitamin C (30 milligrams).

4.3.2 Mean caloric and nutrient intakes for females

Mean daily caloric and nutrient intakes were determined for females in each group (Table 4.12). Mean intakes of kilocalories for subjects in the Sherbrooke Community Center were significantly greater ($p \leq 0.05$) than the recommended level[15] of 1500 calories per day for elderly females. Mean caloric intakes for females in the Meals on Wheels program were low, but did not differ significantly ($p \leq 0.05$) from the recommended levels[15]. Mean niacin intakes for females in the Sherbrooke Community Center were low, but did not differ significantly ($p \leq 0.05$) from recommended levels[15] of 13 milligrams of niacin per day. Mean intakes for females in all groups exceeded recommended levels for protein (41 grams), calcium (700 milligrams), vitamin A (2665 international units), vitamin C (30 milligrams), thiamine (1.0 milligram), and riboflavin (1.2 milligrams).

Table 4.12: Distribution of mean caloric and nutrient intakes for females according to program

Kilocalories and Nutrients	Program: Alliance of Youth and the Elderly (n = 44)	Meals on Wheels (n = 12)	Sherbrooke Community Center (n = 31)
Kilo-calories	1,640 (327 - 3,328)[1]	1,454 (636 - 2,354)	1,705 (743 - 3,290)
Protein (g)	61 (14 - 150)	50 (22 - 103)	64 (31 - 105)
Fat (g)	72 (12 - 191)	57 (14 - 134)	67 (27 - 136)
Calcium (mg)	874 (236 - 4,060)	751 (281 - 1,389)	1,092 (313 - 2,106)
Iron (mg)	16 (1 - 76)	11 (4 - 26)	10 (4 - 17)
Vitamin A (I.U.)	8,314 (1,128 - 21,510)	11,674 (1,191 - 35,728)	7,018 (1,539 - 21,658)
Vitamin C (mg)	152 (2 - 716)	144 (41 - 375)	94 (6 - 337)
Thiamine (mg)	2.2 (.4 - 16.6)	5.0 (.4 - 35.8)	1.0 (.4 - 1.6)
Riboflavin (mg)	2.9 (.5 - 13.2)	4.2 (.6 - 17.0)	1.9 (.6 - 3.5)
Niacin (mg)	26 (2 - 328)	24 (4 - 69)	10 (4 - 24)

[1] ranges

4.3.3 Percentages of individuals in each program below recommended levels for calories and nutrients

Dietary adequacy can be estimated by calculating dietary intake of a nutrient as a percent of recommended dietary intake for that nutrient. Therefore, the percentages of individuals in each group that consumed less than 100 percent and 67 percent of recommended levels for calories and each nutrient were determined.

Fifteen (12.5 percent) of the 120 subjects consumed diets that exceeded recommended levels for calories and eight nutrients. In the Alliance of Youth and the Elderly, 15 (32.6 percent) of the 46 subjects exceeded 120 percent of recommended intakes for calories. Five (20.8 percent) of the 24 subjects in Meals on Wheels and 16 (32 percent) of the 50 subjects in the Sherbrooke Community Center also exceeded 120 percent of recommendations for calories. For individuals in all groups, niacin and thiamine were the nutrients most often consumed at less than 67 percent of recommended levels (Table 4.13). Vitamin A and vitamin C intakes were least often deficient in the diet of subjects in the Alliance of Youth and the Elderly program and the Meals on Wheels program. However, protein and calcium intakes were least often deficient in the diet of subjects from the Sherbrooke Community Center.

4.3.4 Factors affecting nutrient intakes for the 120 subjects in the three programs

Caloric and nutrient intakes of elderly subjects may be affected by different socio-economic and demographic variables. The effects of age, sex, mobility, program, special diet, marital status, and education on the diets of elderly subjects in this survey were determined. A significant

Table 4.13: Percentages of individuals in each group with less than 67 and less than 100 percent of recommended allowances[15]

Kilocalories and Nutrients	Program: Alliance of Youth and the Elderly	Program: Meals on Wheels	Program: Sherbrooke Community Center
Kilocalories			
<100%	41.3	58.3	44
< 67%	15.2	16.7	10
Protein			
<100%	28.3	54.2	12
< 67%	8.7	8.3	4
Calcium			
<100%	41.3	54.2	18
< 67%	23.9	33.3	4
Iron			
<100%	52.2	50.0	42
< 67%	23.9	20.8	14
Vitamin A			
<100%	10.9	8.3	24
< 67%	4.3	8.3	10
Vitamin C			
<100%	13.0	16.7	30
< 67%	8.7	4.2	18
Thiamine			
<100%	56.5	50.0	64
< 67%	23.9	33.3	22
Riboflavin			
<100%	28.3	41.7	20
< 67%	13.0	16.7	10
Niacin			
<100%	56.5	62.5	86
< 67%	32.6	41.7	54

effect ($p \leq 0.05$) of age, sex and program was revealed for the diets of all subjects.

4.3.4.1 Protein intake

Protein intakes of the 120 subjects differed according to age, sex and program (Table 4.14). Subjects aged 65 to 74 years consumed the largest daily quantities of protein. For all subjects, protein intake decreased with age. Males consumed significantly greater ($p \leq 0.05$) amounts of protein than females. Subjects in Sherbrooke Community Center consumed the greatest amount of protein (68 grams) and Meals on Wheels consumed the lowest amount of protein (56 grams).

4.3.4.2 Calcium intake

Subjects in the Sherbrooke Community Center consumed the greatest amount of calcium (1123 milligrams). This intake was significantly ($p \leq 0.05$) greater than calcium intakes of subjects in the Alliance of Youth and the Elderly group and the Meals on Wheels group (Table 4.15).

4.3.4.3 Vitamin A intake

Meals on Wheels subjects consumed an average of 11,356 international units of vitamin A and this intake was significantly greater ($p \leq 0.05$) than intakes of subjects in the Sherbrooke Community Center group and the Alliance of Youth and the Elderly group (Table 4.16).

Vitamin A intakes of the 120 subjects were significantly different ($p \leq 0.05$) across differing categories of sex and marital status (Table 4.17). Unmarried males consumed the lowest amounts of vitamin A (6,183 international units), while divorced males consumed the highest amounts of vitamin A (13,363 international units).

Table 4.14: The effects of age, sex, and program on protein intake for 120 subjects

Factor	Mean Protein Intake[1]
Age[2,3]	
Category	
65 - 74	68
75 - 84	60
≥ 85	59
Sex[3]	
Female	60
Male	70
Program[3]	
Alliance of Youth and the Elderly	61
Meals on Wheels	56
Sherbrooke Community Center	68

[1] protein intake in grams

[2] age category in years

[3] at least one mean is significantly different ($p \leq 0.05$) from the grand mean of 63 grams

Table 4.15: The effect of program on calcium intake for 120 subjects

Factor	Mean Calcium Intake[1]
Program[2]	
Alliance of Youth and the Elderly	886[a]
Meals on Wheels	741[a]
Sherbrooke Community Center	1,123[b]

[1] calcium intake in milligrams per day

[2] means followed by different superscripts are significantly ($p \leq 0.05$) different

Table 4.16: The effect of program on vitamin A intake for 120 subjects

Factor	Mean Vitamin A Intake[1]
Program[2]	
Alliance of Youth and the Elderly	8,190[b]
Meals on Wheels	11,356[a]
Sherbrooke Community Center	6,572[b]

[1] vitamin A intake in international units

[2] means followed by different superscripts are significantly ($p \leq 0.05$) different

Table 4.17: The effect of interaction between sex and marital status on vitamin A intake for 120 subjects

	Mean Intakes[1]			
	Unmarried	Widowed	Divorced	Mean
Male	6,138	9,859	13,363	8,316
Female	9,225	8,265	7,038	7,710
Mean	7,233	8,495	8,092	

[1] vitamin A intake in international units

4.3.5 Factors affecting nutrient intakes for 70 subjects in the Alliance of Youth and the Elderly and the Meals on Wheels program

Data on income, accommodation, sharing of facilities and supplementation were available only for subjects in the Alliance of Youth and the Elderly program and the Meals on Wheels program. The effects of these factors on the diet of elderly subjects in these two programs were determined. A significant effect ($p \leq 0.05$) of supplementation was revealed for the diets of 70 subjects in the Alliance of Youth and the Elderly and the Meals on Wheels program.

4.3.5.1 The effect of supplementation on nutrient intakes

Subjects who took supplements consumed significantly greater ($p \leq 0.05$) amounts of each vitamin and mineral than subjects who did not take supplements (Table 4.18). Except for intakes of calcium and vitamin A, mean nutrient intakes of vitamins and minerals for subjects consuming supplements were greater than double those intakes of subjects not consuming supplements.

4.3.5.2 Vitamin A intake

Vitamin A intake of the 70 subjects were significantly different ($p \leq 0.05$) across differing categories of sex and income (Table 4.19). The highest intakes of vitamin A (19,450 international units) were recorded by females with an income between 5,500 and 6,999 dollars per year. Females with an income between 7,000 and 8,499 dollars per year recorded the lowest intakes (2,483 international units).

Table 4.18: The effects of supplementation on nutrient intake for 70 subjects

Nutrient	Supplementation[1]	Mean Intake[2]
Calcium		
	Yes[3]	993
	No	775
Iron		
	Yes	24
	No	9
Vitamin A		
	Yes	12,311
	No	7,702
Thiamine		
	Yes	5.6
	No	0.9
Riboflavin		
	Yes	6.0
	No	1.4
Niacin		
	Yes	45
	No	11
Vitamin C		
	Yes	223
	No	105

[1] 25 subjects consumed supplements

[2] mean intake in milligrams for all nutrients except vitamin A in international units

[3] mean intakes of those consuming supplements are significantly different ($p \leq 0.05$) for that nutrient from those not consuming supplements

Table 4.19: The effect of interaction between sex and income on vitamin A intake for 70 subjects

	Mean Intakes[1]					
	2500-3999[2]	4000-5499	5500-6999	7000-8499	≥8500	Mean
Male	10,879	14,788	6,699	--	--	10,243
Female	8,206	11,151	19,450	2,483	8,298	9,192
Mean	8,661	12,060	13,074	2,483	8,298	

[1]vitamin A intake in international units

[2]income in dollars per year

4.3.5.3 Vitamin C intake

Vitamin C intakes of the 70 subjects were significantly different ($p \leq 0.05$) over differing categories of supplementation and accommodation (Table 4.20). Subjects consuming supplements who lived in their own homes consumed the highest intakes of vitamin C (299 milligrams). Subjects not consuming supplements who lived in rooming houses consumed the lowest amounts of vitamin C (56 milligrams).

Table 4.20: The effect of interaction between supplementation and accommodation on vitamin C intake for 70 subjects

Mean Intake[1]						
	Accommodation					
Supplementation	Home Owned	Home Rented	Rooming House	Hotel	Apartment	Mean
Yes	299	--	--	--	88	223
No	114	103	56	100	96	104
Mean	186	103	56	100	93	

[1] vitamin C intake in milligrams

5. DISCUSSION

5.1 Description of subjects in the sample

As a group, the 120 subjects surveyed in this study were similar to the population of the elderly in Canada according to marital status, distribution by sex, income and type of accommodation. However, according to education, the subjects in this survey are not representative of the elderly in Canada. Fifty-two percent of subjects in this survey attended high school and 18.3 percent had post-secondary education (Table 4.5). In the national population of the elderly 26 percent attended high school[54] and 11 percent have post-secondary education.

Seventy-three percent of the subjects in this study (Appendix F) were female as compared to 57 percent[54] of the national population of elderly. The Alliance of Youth and the Elderly subgroup consisted of 46 subjects, of whom 44 were female (Table 4.2). The Alliance of Youth and the Elderly subgroup contained more females than the other two subgroups, but this proportion of females accurately represented the true proportion of females in the larger population of the Alliance. All subjects in this study were single. The percentages of unmarried, widowed, and divorced elderly in this study (Appendix F) and in the national population[54] of single elderly are very similar except for widowed subjects. Seventy-six percent of the national population of single elderly are widowed[54] as compared to 69.2 percent in this study (Appendix F).

Subjects in the Alliance of Youth and the Elderly group and the Meals on Wheels group lived in similar types of accommodation as compared to the

national population of the elderly. Fifty-nine percent of the subjects in the Alliance of Youth and the Elderly subgroup and the Meals on Wheels subgroup owned their own homes and 34.3 percent of these subjects lived in apartments (Table 4.7). Nationally,[54] 67.7 percent of all elderly own their own homes and 27.6 percent live in apartments.

All subjects who reported their income (Table 4.9) were receiving Old Age Security payments, and several were receiving the Old Age supplement as well. A single elderly person living alone, who is eligible for Old Age Security and the full supplement would receive 3,252 dollars per year.[a] The majority of subjects in this study appeared to be eligible for the supplement. Incomes for these subjects is similar to the national average income of 3,508 dollars[54] per year for an elderly person living alone.

On the basis of the above parameters the subjects in this study appear to be representative of the larger population of the elderly in Canada.

5.2 Caloric and nutrient intakes

The quality of diet for subjects in the three different support systems was adequate according to the Canadian dietary standard[15] except for subjects in the Sherbrooke Community Center. Niacin and thiamine intakes for males in the Sherbrooke Community Center were significantly lower ($p \leq 0.05$) than recommended levels[15] (Appendix D). Niacin intakes for females in the Sherbrooke Community Center were significantly lower ($p \leq 0.05$) than recommended levels[15] (Appendix E), and caloric intakes for females were significantly greater ($p \leq 0.05$) than recommended levels[15] (Appendix E).

[a]Department of Health and Welfare, Saskatoon, personal communication.

5.2.1 Calories

Women in the Sherbrooke Community Center consumed significantly more ($p \leq 0.05$) calories than recommended[15] for the average elderly female (Appendix E). All subjects in the Sherbrooke Community Center consumed more calories than those subjects living at home (Appendix C). The availability of food for residents in the institution without the necessity of purchasing and preparation may encourage the consumption of greater quantities of food. Those subjects living at home must buy and prepare their own food and this task becomes harder with advancing age.

The mean caloric intake (1,705 kilocalories) of females in the Sherbrooke Community Center was 175 kilocalories per day greater than the mean caloric intake of the national elderly population in the Nutrition Canada[16] survey (Table 2.1). The mean caloric intake of 1705 kilocalories was greater than mean intakes for independent living females in several surveys[41,35,56,66] but lower than the mean intakes for institutionalized females in other surveys[5,46].

The mean caloric intake (1912 kilocalories) of males in the Sherbrooke Community Center was greater than mean intakes for independent living males in various surveys[41,56,a] but lower than mean intakes for institutionalized males in different surveys[5,46]. These studies appear to support the increased probability of institutional subjects consuming more calories than subjects living at home.

Caloric intake has been reported to decrease with age[a,5,13,60,63]. No effect of age on calorie consumption was found in this study. These results suggest that the amount of food consumed does not change with

[a]Monagle, J. E., personal communication.

increasing age. Differences in food consumption between different age levels of elderly people may be due to factors other than age, such as differences in body size and composition,[43] and underlying physical illnesses[22].

Forty to sixty percent of the subjects in each subgroup were below 100 percent of recommended[15] intakes for calories (Table 4.13). The standards may be unnecessarily high for sedentary elderly people. Elderly people are less active than the rest of the population[45], and their caloric requirements are decreased. Monagle[a] has suggested that the elderly are frequently rated as being deficient especially for calories as they are assessed against the standards set for younger adults.

Garn[25] has suggested that one day dietary records cannot be used to estimate the proportion of individuals at nutritional "risk". His results indicated that the large variability in intakes from one day dietary records decreased for the same individuals using seven day dietary records. The high percentages of subjects in the present survey who are consuming less than recommended levels of calories (Table 4.13), may not accurately reflect the true caloric status of these subjects.

5.2.2 Protein

Intakes of protein for males (Table 4.11) and females (Table 4.12) in all subgroups exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E).

Males and females in all groups, except for females in the Meals on Wheels program consumed more protein (Table 4.12) than elderly males and

[a]Monagle, J. E., personal communication.

females in the Nutrition Canada[16] survey (Table 2.1). Protein intakes were estimated using standards developed by Nutrition Canada[16]. Males and females in the present survey consumed a lower percentage of "inadequate" diets (Appendix I) for protein than elderly male and females in the national survey[16] (Table 2.2).

Mean intakes of protein for males (70 grams) and females (60 grams) in the present survey (Table 4.14) were similar to results from other surveys[5,13,41,56]. The results of this survey suggest that protein intakes were adequate in the populations that were examined.

Protein intakes in this study were affected by age. Mean protein intakes of at least one age category (Table 4.14) were significantly different ($p \leq 0.05$) from the overall mean of 63 grams. The multiple range tests[52] were not able to discern which groups were significantly different ($p \leq 0.05$). Subjects 65 to 74 years of age consumed the largest amount of protein (68 grams). Protein intake was lower for the older age group (Table 4.14). Jansen[35] reported similar effects of age on protein intake as subjects 62 to 75 years old consumed more protein than those subjects aged 76 to 85 years. The Panel of Nutrition of the Elderly[13] found that in both sexes those subjects over 75 years of age did not consume as much protein as the younger subjects. In the present survey, subjects 85 years of age and over consumed the lowest amounts of protein (59 grams). However, mean protein intakes for those subjects remained greater than recommended allowances.[15]

Protein intakes were affected by program as the mean protein intake of subjects in at least one program[52] were significantly different ($p \leq 0.05$) from the overall mean of 63 grams. However multiple range tests[52]

were not able to discern which means were significantly different ($p \leq 0.05$). Subjects in the Sherbrooke Community Center consumed greater amounts of protein than subjects in the other two subgroups (Table 4.14). Bransby[5] did not find any difference in protein intakes of subjects living at home or in institutions (Table 2.14). Brown[6] and Jansen[35] found that those living in private homes consumed significantly more ($p \leq 0.05$) protein than subjects in institutions. Results of this study and others[6,13,35] do not reveal a consistent difference in protein intake between institutional and free-living subjects.

5.2.3 Fat

The consumption of fat by the subjects in all three groups was slightly higher than recommended levels[15] (Appendix H). Thirty to 35 percent of the total consumption of calories are recommended to be in the form of fat. In Canada, there is a high frequency of heart disease and death from atherosclerosis[18]. Elevated blood lipids (cholesterol and triglycerides) are considered to be a risk factor for atherosclerosis and heart disease. A relationship exists between the levels of dietary saturated fats and cholesterol consumed with high plasma cholesterol levels[18]. Therefore, high levels of fat in the diet are discouraged.

Males in the present survey (Table 4.11) consumed more fat than males in the Nutrition Canada[16] survey (Table 2.1). Females in the present survey, in all groups except Meals on Wheels consumed more fat (Table 4.12) than females in the Nutrition Canada[16] survey (Table 2.1).

Forty percent of the total calories for subjects in the Alliance of Youth and the Elderly, 35.4 percent of total calories for subjects in the Meals on Wheels group, and 36 percent of total calories for subjects in the

Sherbrooke Community Center, were consumed in the form of fat (Appendix H). These percentages for subjects in all groups are slightly greater than recommended allowances[18].

5.2.4 Calcium

Intakes of calcium by males (Table 4.11) and females (Table 4.12) in all subgroups, met or exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E).

Males and females in all groups consumed more calcium than elderly males and females in the Nutrition Canada[16] survey (Table 2.1). Calcium intakes were estimated using standards developed by Nutrition Canada[16]. The percentages of diets "inadequate" in calcium intakes (Appendix I) for males (3 percent) and females (4.6 percent) were lower than the percentages of "inadequate" diets for males (9.9 percent) and females (20 percent) in the national sample (Table 2.2). Leichter,[41] using Nutrition Canada[16] standards (Table 2.8), found similar percentages of "inadequate" diets for males (ten percent) and females (16 percent) as compared to the national sample[16]. Subjects in the present survey fared considerably better in calcium intakes than the national sample[16] of elderly.

Program affected calcium intake (Table 4.15). Subjects in the Sherbrooke Community Center consumed significantly more ($p \leq 0.05$) calcium (1,123 milligrams) than subjects in the Meals on Wheels program (741 milligrams) or the Alliance of Youth and the Elderly (886 milligrams). Males in the Meals on Wheels program consumed a mean intake of 732 milligrams of calcium (Table 4.11). This value for males was higher than the mean calcium intake of males (690 milligrams) reported by Moore[46] in a study of Meals on Wheels recipients (Table 2.16) but lower than reported values

in several other studies[5,13,41,46]. Fifty-four percent of the Meals on Wheels subjects were below 100 percent of recommendations[15] for calcium consumption and 33.3 percent were below 67 percent of recommended intakes[15] for calcium (Table 4.13). Diets of Meals on Wheels subjects were most often deficient in calcium. Reid[56] (Table 2.4) and Johnson[36] (Table 2.5) found a smaller percentage of deficient diets for their subjects although calcium intakes were lower than those reported in the present survey. However, recommended intakes[10] for calcium (500 milligrams), at the time of their surveys, were 300 milligrams lower than the present standards[15] for males (800 milligrams) and females (700 milligrams). Perhaps the availability of milk at every meal and snack in the Sherbrooke Community Center provided a readily available source of dietary calcium. This could account for the observed difference in calcium intakes between institutional and Meals on Wheels subjects as milk is not provided in the Meals on Wheels program. Elderly males and females in the Nutrition Canada[16] survey did not meet recommended[15] levels of calcium. Therefore, Health and Welfare Canada[20] suggested that "consideration should be given to programs encouraging some increase in the consumption of milk products and cheese" for the elderly.

5.2.5 Iron

Intakes of iron by males (Table 4.11) and females (Table 4.12) in all subgroups exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E). Males in all subgroups (Table 4.11) consumed less iron than elderly males in the Nutrition Canada[16] survey (Table 2.1). Females in the Sherbrooke Community Center consumed the same amounts of iron as females in the national survey (10 milligrams), while females in the two other subgroups consumed more

iron (Table 4.12) than females in the national survey[16] (Table 2.1). Using standards developed by Nutrition Canada[16] males in the present survey (Appendix I) consumed slightly more "inadequate" diets (6.1 percent) as compared to males in the national survey[16] (Table 2.2). Females in the present survey (Appendix I) consumed more than double the percentage of "inadequate" diets (20.7 percent) as compared to females (8.4 percent) in the national survey[16] (Table 2.2). Murray[41] reported that iron intakes were often deficient in the diets of elderly subjects in the Nutrition Canada[16] survey. Greater than 20 percent of the subjects in the Alliance of Youth and the Elderly and the Meals on Wheels program consumed less than 67 percent of recommended levels[15] of iron (Table 4.13). Similar low iron intakes from other studies[13,41,46,48,56] have been reported, indicating that iron consumption is chronically low for elderly subjects.

Jansen[35] and Bransby[5] found no difference between iron intakes of female residents of institutions and females living at home. In the present survey (Table 4.12), females in the institution consumed less iron (10 ± 4 milligrams) than women in the Alliance of Youth and the Elderly (16 ± 19 milligrams) or the Meals on Wheels program (11 ± 7 milligrams).

Subjects in the Sherbrooke Community Center consumed more diets that were above recommended levels[15] of intake for iron than subjects in the other two subgroups (Table 4.13). These results indicate that females in the Sherbrooke Community Center had better intakes for iron than female subjects in the Meals on Wheels program and the Alliance of Youth and the Elderly. Although mean iron intakes for females in the Sherbrooke Community Center were lower than mean iron intakes for females in other subgroups, the range of iron intakes for females in the Sherbrooke Community Center was

not as large as those ranges in the other subgroups (Table 4.12). Perhaps this explains the greater number of females consuming diets closer to recommended levels[15] of intake in the Sherbrooke Community Center as compared to the other two groups. Jansen[35] observed a decreased iron intake with age, but education and income had no apparent affect on iron intakes. The results of the present survey did not indicate an effect of age, education or income on iron intake.

5.2.6 Vitamin A

Intakes of vitamin A for males (Table 4.11) and females (Table 4.12) in all subgroups exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E). Males and females in all groups consumed more vitamin A than subjects in the Nutrition Canada[16] survey (Table 2.1). Vitamin A intakes were estimated using standards developed by the Nutrition Canada[16] survey. The percentages of diets "inadequate" in vitamin A intakes (Appendix I) for males (3 percent) and females (5.2 percent) were considerably lower than percentages of "inadequate" diets for males (23.1 percent) and females (32.1 percent) in the national sample (Table 2.2). Murray[51] reported that the diets of elderly subjects in Nutrition Canada[16] were most often deficient in vitamin A. Results of the present survey indicate that vitamin A intakes were almost always adequate in the diet (Table 4.13).

Reid[56] and Johnson[36] found that 26 to 45 percent of diets of the elderly were below daily recommended intakes[10] for vitamin A. Vitamin A intakes of subjects in the present survey were also higher than results reported in major surveys outside Canada[5,13,66]. A possible explanation for the high intakes of vitamin A may be the emphasis on fruit and vegetable

servings by both the Meals on Wheels program and the Sherbrooke Community Center.

Bransby[5] found that women in institutions consumed higher amounts of vitamin A while Harrill[31] reported no difference in vitamin A intakes between those living at home and those living in institutions. Brown[6] found that males and females at home consumed significantly more vitamin A than residents of an institution. In the present survey, the type of program affected the intake of vitamin A (Table 4.16). Subjects in the Sherbrooke Community Center consumed less than all subjects living at home and significantly less ($p \leq 0.05$) than subjects in the Meals on Wheels program. These differences between home-living and institutional subjects are due partly to the effects of supplementation (Appendix J). Eight members of the Alliance of Youth and the Elderly group and seven members of the Meals on Wheels group supplemented their diets with vitamin A. Subjects in the Sherbrooke Community Center did not supplement their diets with vitamin A. Average intakes of vitamin A for all three groups are similar when the effects of supplementation are removed (Appendix J).

A significant interaction ($p \leq 0.05$) occurred between sex and marital status on vitamin A intakes of the subjects in all three groups (Table 4.17). The highest intakes of vitamin A were recorded by divorced males. Intakes of vitamin A were not consistent across different categories of sex and marital status.

A significant interaction ($p \leq 0.05$) occurred between sex and income on vitamin A intakes of subjects in the Alliance of Youth and the Elderly and the Meals on Wheels program (Table 4.19). The lowest intakes for all levels of income were found for females (2,483 international units) earning

7,000 to 8,499 dollars per year. The presence of high income apparently did not guarantee an adequate intake of vitamin A.

5.2.7 Vitamin C

Vitamin C intakes for males (Table 4.11) and females (Table 4.12) in all groups exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E). Vitamin C intakes for males and females in the present survey exceeded intakes for elderly males and females in the Nutrition Canada[16] survey (Table 2.1). Using standards developed by Nutrition Canada[16], three percent of males and 4.6 percent of females consumed "inadequate" diets for vitamin C (Appendix I). In the national survey[16], four percent of the elderly males and 1.9 percent of the elderly females consumed "inadequate" diets for vitamin C. The results of the present survey and other Canadian studies[16,41,48,56] indicate that elderly Canadians are not at a nutritional disadvantage in their intakes of vitamin C.

A significant interaction ($p \leq 0.05$) was found between supplementation and accommodation on vitamin C intakes for subjects in the Alliance of Youth and the Elderly and the Meals on Wheels program (Table 4.20). Subjects living in their own homes who supplemented their diets consumed the greatest amounts of vitamin C (299 milligrams). Subjects living in apartments who supplemented their diets consumed the second lowest amounts of vitamin C (88 milligrams). These results did not indicate a consistent pattern of intake across different categories of accommodation and supplementation.

5.2.8 Thiamine

Intakes of thiamine by females (Table 4.12) in all groups and by males (Table 4.11) in the Meals on Wheels program met or exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E). Thiamine intakes for males in the Sherbrooke Community Center and males in the Alliance of Youth and the Elderly were significantly lower ($p \leq 0.05$) than recommended intakes[15] (Appendix D). Data for males in the Alliance of Youth and the Elderly program are probably not valid because of the low sample number.

Thiamine intakes for males (Table 4.11) in the Meals on Wheels program and males in the Sherbrooke Community Center met or exceeded intakes for elderly males in the Nutrition Canada[16] survey (Table 2.1). Thiamine intakes for females (Table 4.12) in the present survey exceeded intakes of elderly females reported in the Nutrition Canada[16] survey (Table 2.1).

The adequacy of thiamine intakes were determined used standards developed by Nutrition Canada[16] (Appendix I). Males in the present survey consumed a similar percentage of "inadequate" diets (9.1 percent) as compared to males in the Nutrition Canada[16] survey (10.7 percent). Females in the Nutrition Canada[16] survey (Table 2.2) had a greater percentage of "inadequate" diets (14.5 percent) as compared to females in this study (6.9 percent). Leichter[41] reported that 14 percent of males and 16 percent of females consumed inadequate diets (Table 2.8). Results of the present survey appear to be consistent with the results of Leichter[41] and Nutrition Canada[16].

Average intakes of thiamine for males in the Sherbrooke Community Center (1.0 milligrams) are deficient (Table 4.11). Results for males reported by Leichter[41] (1 milligram), Bransby[5] (1.1 milligrams), Reid[56]

(1.05 milligrams), Miles[46] (1.14 milligrams) and the Ten State Nutrition Survey[66] (1.14 milligrams) are also low. Results of the present survey and others[5,41,46,56,66] indicate that thiamine intakes for males are chronically insufficient.

5.2.9 Riboflavin

Intakes of riboflavin by males (Table 4.11) and females (Table 4.12) in all subgroups exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E). Males and females in all groups consumed more riboflavin than subjects in the Nutrition Canada[16] survey (Table 2.1). Riboflavin intakes were estimated using standards developed by the Nutrition Canada[16] survey.

The percentage of diets "inadequate" in riboflavin for males (six percent) in this survey (Table A.5) were slightly higher than the percentage of "inadequate" diets (Table 2.2) for elderly males (4.3 percent) reported in the national survey[16]. The percentage (Appendix I) of "inadequate" riboflavin intakes for females (six percent) in the present survey were considerably lower than the percentage of "inadequate" diets (Table 2.2) for elderly females (36.8 percent) in the national survey. Several studies[5, 13,41,56,66] have reported lower intakes of riboflavin for elderly males and females than were found in the present survey. Only Miles[46] (Table 2.6) reported higher mean intakes of riboflavin for femlaes. Although subjects in the present survey consumed adequate amounts of riboflavin the results of other studies[5,13,41,16,56,66] suggest that intakes of riboflavin in the diets of the elderly is marginally adequate.

5.2.10 Niacin

Intakes of niacin for males (Table 4.1) and females (Table 4.12) in the Alliance of Youth and the Elderly and the Meals on Wheels programs, met or exceeded recommended intakes[15] for the average elderly male (Appendix D) and the average elderly female (Appendix E). Niacin intakes for males and females in the Sherbrooke Community Center were significantly lower ($p \leq 0.05$) than recommended intakes[15].

The Dietary Standard for Canada[15] includes the tryptophan contribution to the total niacin intake. However, the Handbook of the Nutritional Contents of Foods[69] reports only the preformed niacin content of foods in the diet. The high percentage of diets deficient in niacin for subjects in the present survey (Table 4.13) inaccurately reflects the niacin status of these subjects. Calculations for the percentage of deficient diets are based solely on the preformed niacin content of foods consumed. Pike[55] estimates that one percent of protein is tryptophan. Adjusted niacin intakes (Appendix L) to include the tryptophan contribution indicate that subjects in the present survey are adequately meeting their dietary needs for niacin.

Niacin intakes for males (28 niacin equivalents) and females (21 niacin equivalents) in the Nutrition Canada[16] survey (Table 2.1) exceeded recommended intakes[15]. The percentage of "inadequate" diets for males (1.6 percent) and females (4.7 percent) was lower than percentages for most other nutrients (Table 2.2). These results[16] and results of the present survey (Appendix L) indicate that niacin intakes are adequate for elderly Canadians.

Observed differences in niacin intakes between subgroups (Appendix C) in the present survey were due to supplementation of the diet (Appendix J).

Ten members of the Alliance of Youth and the Elderly groups and seven members of the Meals on Wheels group supplemented their diets with niacin. Subjects in the Sherbrooke Community Center did not supplement their diets with niacin. Niacin intakes for the subjects in all three groups are nearly identical when the effects of supplementation are removed (Appendix L).

5.3 Factors affecting calorie and nutrient intakes of the elderly

Results of the present survey indicated significant effects ($p \leq 0.05$) of age and sex on protein intakes (Table 4.14), and significant effects ($p \leq 0.05$) of progam on protein, calcium (Table 4.15) and vitamin A (Table 4.16) intakes of all subjects. Significant interactions ($p \leq 0.05$) were found between sex and marital status (Table 4.17) for vitamin A intakes of all subjects and between sex and income (Table 4.18) for vitamin A intakes of subjects in the Meals on Wheels program and the Alliance of Youth and the Elderly. Significant interaction ($p \leq 0.05$) was found between supplementation and accommodation (Table 4.19) for subjects in the Meals on Wheels program and the Alliance of Youth and the Elderly. No significant effects ($p \leq 0.05$) were found for education, special diet, or mobility rating on caloric and nutrient intakes of the subjects.

5.3.1 Age

No consistent effect of age on nutrient intakes was found except for protein. For the 120 subjects, protein intake decreased with age (Table 4.14). An increase in underlying physical disabilities[22] with age could lead to decrease in nutrient consumption. Two of the three groups in this survey were provided with meals. This availability of food may have offset any

handicaps which might occur with age and increased disabilities that prevent the purchase and preparation of food.

5.3.2 Sex

Sex did not affect intakes of calories and nutrients except for the intakes of vitamin A (Table 4.19) and protein (Table 4.14). Men have higher recommended intakes of protein than women which are partly based on actual food consumption levels. Consequently, a difference for protein, and possibly calories, could be expected to occur. Recommended intakes[15] for other nutrients are similar for men and women.

The subjects were not evenly distributed according to sex. The sample from the Alliance of Youth and the Elderly program had only two male subjects. This distribution resulted from random sampling which reflected the true proportion of males and females in the Alliance of Youth and the Elderly. Subjects in the Meals on Wheels program and the Sherbrooke Community Center were more evenly distributed according to sex.

5.3.3 Program

Program affected dietary intakes of protein (Table 4.14), calcium (Table 4.15) and vitamin A (Table 4.16). Intakes of calories and nutrients for males (Table 4.11) and females (Table 4.12) do not indicate a nutritional advantage for any of the three programs. Males in the Sherbrooke Community Center consumed inadequate levels of thiamine (Appendix D), but all other nutrients were in excess of recommendations[15]. The Alliance of Youth and the Elderly program does not provide meal service but the help provided by the program may allow elderly subjects the time and energy to maintain a good diet. Although the Meals on Wheels program provides only

one hot meal per day, the meal is substantial and can provide the basis of a good diet.

5.3.4 Marital status

Marital status did not affect nutrient and calorie intakes. Single males may consume better diets than widowed or divorced males.

Widowed and divorced men may not be knowledgeable in the purchasing and preparation of food because, until the time of separation, meals were probably prepared by the women. Widowed and divorced females may lose interest in preparation of food for one. The findings of this study did not support these hypotheses.

5.3.5 Income

Data on income were only available for subjects in the Meals on Wheels and the Alliance of Youth and the Elderly programs. Subjects in the Sherbrooke Community Center receive Old Age Security payments but costs of institutional living exceeds these payments. The difference in fees to the resident is provided by government agencies.[a] Therefore the average cost of upkeep per resident would not reflect their personal income and would not affect the quality of diet in the same manner as the income received by subjects in the other two groups.

No direct effect of income was observed, although a significant interaction ($p \leq 0.05$) was found between sex and income for vitamin A intakes of subjects in the Meals on Wheels and Alliance of Youth and the Elderly programs (Table 4.19). Reid[56] and Monagle[b] found that diets of the elderly improved as income increased, while Caird[8] found that the

[a]Natalie Threlfall, dietician Sherbrooke Community Center, personal communication
[b]Monagle, J. E., personal communication.

quality of diet decreased as amounts spent on food per week decreased. The results of the present survey did not indicate an effect of income on the quality of diet. The amount of money spent on food may be expected to reflect dietary adequacy but most subjects in the present survey were unable to recall amounts spent on food per week.

5.3.6 Supplementation

Those subjects who supplemented their diets, consumed significantly greater ($p \leq 0.05$) amounts of all vitamins and minerals (Table 4.18). A balanced diet should not require supplementation. A varied intake can provide all the nutrients necessary to lead a healthy life. The elderly are concerned with their health but may be needlessly spending money on vitamin and mineral supplements. The problem is more serious as the elderly have the lowest income in the total adult population[54].

Twenty-five subjects from the Meals on Wheels program and the Alliance of Youth and the Elderly supplemented their diets. Subjects in the Sherbrooke Community Center did not have their diets supplemented as part of the regular meal program.[a] The value of this supplementation for the subjects in the Meals on Wheels and Alliance of Youth and the Elderly programs was questionable as the subjects who did not supplement their diets met recommended levels[15] for most nutrients. Consumption of supplements by three subjects (Appendix K) raised 15 deficient nutrient intakes to recommended levels[15]. For these individuals supplementation was of definite value but indicates the poor quality of the overall diet. For the total group of subjects in the Meals on Wheels program and the Alliance of Youth and the Elderly, supplementation was not a factor in the diet.

[a]Natalie Threllfall, personal communication

5.3.7 Accommodation

Accommodation did not directly affect caloric or nutrient intakes for 70 subjects in the Meals on Wheels program or the Alliance of Youth and the Elderly program. However, a significant interaction ($p \leq 0.05$) was observed between accommodation and supplementation for these subjects. Subjects living at home did not consume better diets than subjects living in apartments, hotels, rooming houses or other types of accommodation.

5.3.8 Education

Education did not affect calorie or nutrient intakes of all subjects. Monagle[a] found that subjects with high school education consumed better diets and Harrill[31] found subjects with high school education consumed the most niacin. Jansen[35] found no effect of education on protein or iron intake. Subjects with higher education may be expected to be more aware of their nutritional needs and consume a better diet. Results of the present survey did not indicate that subjects with higher education consumed better diets than subjects with less education.

5.3.9 Special diet

The consumption of a special diet did not affect caloric or nutrient intakes of subjects in the present survey. Subjects on special diets would be expected to consume better diets because they must be more aware of their nutrient needs. Diets prescribed by doctors usually have an education component in order to teach the subject the types of foods to avoid or ingest. Leichter[41] reported on the consumption of special diets

[a]Monagle, J. E., personal communication.

in his survey but no influence on nutrient intake was suggested. In the present survey, no effect on nutrient intakes were found for subjects consuming special diets.

5.3.10 Mobility

In the present survey, subjects level of mobility did not affect calorie or nutrient intakes. The scale of mobility was designed to reflect differing degrees of health status. Caird[8] and Exton-Smith[22] found significant decreases in intake as impairment in health increased. The results of the present survey do not indicate a decline in nutrient intakes with increased disabilities.

6. SUMMARY AND CONCLUSIONS

This survey was conducted in order to determine the dietary adequacy of three different support systems for the elderly. Calorie and nutrient intakes of all subjects was recorded using the 24 hour recall method. The effects of socio-economic and demographic data on calorie and food intakes were statistically assessed.

Results of this survey indicated that males and females in the Alliance of Youth and the Elderly and the Meals on Wheels programs consumed diets that met Canadian recommendations. Males in the Sherbrooke Community Center met Canadian recommendations for calories and all nutrients except thiamine (1 milligram). Females in the Sherbrooke Community Center met recommendations for all nutrients, but calorie consumption (1705 kilocalories) exceeded recommended levels of intake. The protein intakes of all subjects were affected by differences in age, and sex. Protein, calcium and vitamin A intakes differed for all subjects according to type of support system but none of the support systems were at a nutritional advantage as compared to the other support systems.

Subjects in all three programs consumed adequate or near-adequate diets. Subjects in the Alliance of Youth and the Elderly consumed diets adequate for calories and all nutrients. Meal service is not provided by the Alliance of Youth and the Elderly but the help that is provided may allow time for subjects to prepare and maintain a proper diet. Subjects in the Meals on Wheels program consumed diets adequate for calories and all nutrients. Intakes of calcium were marginally low, probably because dairy

products are not included as part of the meal service. Meals on Wheels is an important part of the lives of the single elderly as the program meets social and emotional needs as well as nutritional needs. Subjects from the Sherbrooke Community Center consumed the lowest amounts of thiamine, riboflavin, and niacin. The Sherbrooke Community Center looks after all the needs of their residents, and perhaps consideration should be given to the possibility of improving the diet with respect to these nutrients.

The results of this survey did not indicate any consistent effects of socio-economic conditions of the elderly on their caloric and nutrient intakes. This survey does indicate that Meals on Wheels subjects can adequately meet their nutritional needs living at home.

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APPENDICES

APPENDIX A

The Questionnaire

The first part of the questionnaire was used to record socio-economic and demographic characteristics for each subject. Subjects were asked to name their favourite foods. These foods and the foods listed from Nutrition Canada[16] formed the probe.

The second part of the questionnaire was used to record all food consumed on the day prior to the interview. Each food item listed in the Handbook of The Nutritional Contents of Foods[69] has a four digit code number. For each food consumed by the subject the corresponding number was recorded in the "CODE" column.

Each food model was coded with a combination of letters for identification. The letters on each food model chosen by subjects were recorded in the "I.D." column. The name of the food consumed was recorded in the "Food or Drink" column.

A food model could represent a portion of food consumed. The number of portions in the whole food item were recorded in the "QUANT" column.

Each food model was calibrated in fluid ounces and cubic inches. The volume of each food model chosen by subjects was recorded in the "VOL" column. The letter "F", "I", "C", or "U", preceeded the volume to indicate fluid ounces (F), cubic inches (I), cups (C), or units (U). A unit was one item (eg. a banana).

Pie-shaped, circular and rectangular food models were two-dimensional in shape. The third dimension was assessed using a thickness guage ranging from one thickness to nine thicknesses. The number of thicknesses was recorded in the "TH" column. Total volume for each food consumed was

APPENDIX A (continued)

calculated by multiplying "QUANT" by "VOL" by "TH".

The Handbook of the Nutritional Contents of Foods[69] gives nutrient contents for 100 grams edible portion of each food listed. An intermediate conversion table[48] was used to convert fluid ounces, cups, and cubic inches of each food consumed into grams.

ARE YOU ON A SPECIAL DIET? YES_____NO_____

DO YOU TAKE ANY MINERAL OR VITAMIN TABLETS? YES_____NO_____

Ca (mg)_____ Fe (mg)_____ Vit A (I.V.)_____ Thi (mg)_____

Riboflavin (mg)_____ Niacin (mg)_____ Vit C (mg)_____

WHAT IS YOUR TOTAL INCOME PER YEAR? _____

HOW MUCH DID YOU SPEND ON FOOD LAST WEEK?_____

HOW MANY YEARS WERE YOU IN SCHOOL INCLUDING TRADE SCHOOL?_____

COOKING FACILITIES YES_____NO_____N.A._____

STORAGE OF PERISHABLES YES_____NO_____N.A._____

MOBILITY BEDRIDDEN_____

HOUSEBOUND UNABLE TO COOK _____

HOUSEBOUND ABLE TO COOK_____

MOBILE UNABLE TO PURCHASE FOOD_____

MOBILE ABLE TO PURCHASE FOOD_____

INTERVIEW COMPLETE_____ NOT COMPLETED_____

TYPICAL DAY YES_____ NO_____

ODE	I.D.	FOOD OR DRINK	QUANT.	VOL.	THI

APPENDIX B

Food Models

Subjects often have difficulty in assessing the quantities of food that they have consumed. Therefore food models[16,47,48,66] were constructed in varying shapes and sizes in order to represent different amounts of all types of food. Models were calibrated in cubic inches and fluid ounces. All objects were immersed in water and the displaced water was measured in fluid ounces. Fluid ounces were converted to cubic inches using the formula: 1 fluid ounce = 1.73387 cubic inches[67].

Ball shaped models were constructed by using different sized styrofoam balls covered with instant paper maché. A white enamel paint and a coat of liquid plastic were used to harden and protect these models.

Mound shaped models were constructed with paper maché on cardboard bases. Needlepoint mesh was used to enclose the models in order to help maintain the proper shape. After drying, the mounds were painted and sprayed with a liquid plastic in order to protect these models.

Rectangular, square, cylindrical, and triangular wooden blocks were cut to size, sanded, varnished and sprayed with a plastic coating. A series of pie shapes, square, rectangular, and circular shapes were cut one-seventh of an inch thick from masonite and varnished. Common plastic cups were calibrated in ounces. Various sized spoons were filled with paper maché to different levels. After drying, the spoons were painted and sprayed with a liquid plastic.

APPENDIX C

Mean caloric and nutrient intakes for 120 subjects according to program

Kilocalories and Nutrients	Program: Alliance of Youth and the Elderly	Meals on Wheels	Sherbrooke Community Center	Grand Mean
Kilocalories	1,653 ± 626[1]	1,628 ± 576	1,784 ± 613	1,703 ± 700
Protein (g)	61 ± 31	56 ± 24	68 ± 22	63 ± 26
Fat (g)	73 ± 40	64 ± 33	72 ± 33	71 ± 36
Calcium (mg)	886 ± 636	741 ± 371	1,123 ± 464	956 ± 540
Iron (mg)	16 ± 19	11 ± 5	11 ± 4	13 ± 13
Vitamin A (IU)	8,190 ± 5,462	11,356 ± 8,657	6,572 ± 4,603	8,149 ± 6,133
Vitamin C (mg)	152 ± 150	138 ± 133	93 ± 80	125 ± 124
Thiamine (mg)	2.1 ± 3.4	3.5 ± 7.2	1.0 ± .4	1.9 ± 3.9
Riboflavin (mg)	2.9 ± 2.9	3.3 ± 3.7	1.9 ± .7	2.6 ± 2.5
Niacin (mg)	25 ± 50	19 ± 16	10 ± 4	17 ± 32

[1] standard deviations

APPENDIX D

Confidence intervals and recommended allowances for calories and nutrients according to program for male subjects

Kilocalories and Nutrients	Program: Alliance of Youth and the Elderly (n = 2)	Meals on Wheels (n = 12)	Sherbrooke Community Centre (n = 19)	Recommended Allowances
Kilocalories	1,225 to 2,655	1,662 to 2,141	1,572 to 2,094	2000
Protein (g)	49 to 89	49 to 75	63 to 88	56
Fat (g)	52 to 118	54 to 90	67 to 89	
Calcium (mg)	591 to 1,737	563 to 901	916 to 1,433	800
Iron (mg)	4 to 20	9 to 14	9 to 14	10
Vitamin A (I.U.)	1,483 to 9,461	7,758 to 14,318	4,090 to 7,599	3330
Vitamin C (mg)	0 to 356	31 to 232	56 to 128	30
Thiamin (mg)	.7 to 1.3[1]	.2 to 3.7	.8 to 1.2[1]	1.4
Riboflavin (mg)	2.1 to 2.1	.6 to 4.0	1.7 to 2.4	1.7
Niacin (mg)	4 to 28	7 to 23	9 to 13[1]	18

[1] confidence interval is lower than recommended allowance

APPENDIX E

Confidence intervals and recommended allowances for calories and nutrients according to program for female subjects

Kilocalories and Nutrients	Program: Alliance of Youth and the Elderly (n = 44)	Meals on Wheels (n = 12)	Sherbrooke Community Centre (n = 31)	Recommended Allowances
Kilocalories	1,447 to 1,834	1,083 to 1,825	1,505 to 8,892	1500
Protein (g)	51 to 70	32 to 67	57 to 71	41
Fat (g)	60 to 85	33 to 80	55 to 79	
Calcium (mg)	677 to 1,070	455 to 1,046	931 to 1,247	700
Iron (mg)	10 to 22	6 to 15	10 to 16	9
Vitamin A (I.U.)	6,628 to 10,000	4,435 to 18,914	5,143 to 8,892	2665
Vitamin C (mg)	106 to 199	75 to 212	63 to 125	30
Thiamin (mg)	1.1 to 3.2	-1.1 to 11.3	.8 to 1.1	1.
Riboflavin (mg)	2.0 to 3.9	1.4 to 7.1	1.6 to 2.1	1.2
Niacin (mg)	10 to 41	12 to 35	8 to 11[1]	13

[1] confidence interval is lower than recommended allowance

APPENDIX F

Descriptive statistics for 120 subjects according to program

	Program			Totals	
	Alliance of Youth and the Elderly (n=46)	Meals on Wheels (n=24)	Sherbrooke Community Center (n=50)	Number	Percent
Age (years)					
65-74	22	10	12	44	36.7
75-84	19	7	20	46	38.3
≥85	5	7	18	30	25.0
Mean	76.1	78.7	81.0		
Standard Deviation	6.86	9.7	8.6		
					100.0
Sex					
Male	2	12	19	33	27.5
Female	44	12	31	87	72.5
					100.0
Marital Status					
Unmarried	3	5	23	31	25.8
Widowed	41	17	25	83	69.2
Divorced	2	2	2	6	25.0
					100.0
Education (years)					
0-7	8	7	12	27	22.5
8-12	26	14	22	62	51.7
≥13	10	3	9	31	25.8
Mean	10.32	8.38	8.65		
Standard Deviation	3.5	3.82	4.43		
Missing Cases	2	0	7		
					100.0
Mobility Rating					
Bedridden	0	0	0	0	0
Housebound Unable to Cook	1	5	8	9	7.5
Housebound Able to Cook	3	5	9	17	14.2
Mobile Unable to Purchase Food	5	5	11	21	17.5
Mobile Able to Purchase Food	37	14	22	73	60.8
					100.0
Special Diet					
Yes	15	9	17	41	34.2
No	31	15	33	79	65.8
					100.0

APPENDIX G

Descriptive statistics for 70 subjects of Meals on Wheels and the Alliance of Youth and the Elderly

	Program		Total	
	Alliance of Youth and the Elderly	Meals on Wheels	Number	Percent
Supplements				
Yes	15	10	25	35.7
No	31	14	55	64.3
				100.0
Accommodation				
Home Owned	13	28	41	58.7
Home Rented	1	1	2	2.8
Rooming House	1	1	2	2.8
Hotel	1	-	1	1.4
Apartment	8	16	24	34.3
				100.0
Sharing				
Yes	5	1	6	8.6
No	41	23	64	91.4
				100.0
Income (dollars)				
≤ 2499	0	0	0	
2500-3999	32	15	47	67.2
4000-5499	5	3	8	11.4
5500-6999	5	3	8	11.4
7000-8499	0	2	3	4.3
≥ 8500	1	0	0	0.0
Missing Cases	3	1	4	5.7
				100.0

APPENDIX H

Kilocalories from fat as a percentage of total calories for 120 subjects according to program

	Program		
	Alliance of Youth and the Elderly n = 46	Meals on Wheels n = 24	Sherbrooke Community Center n = 50
Mean Fat Intake (g)	73	64	72
Kilocalories from Fat	657[1]	576	648
Total Kilocalories Consumed	1653	1628	1784
$\frac{\text{Kilocalories from Fat}}{\text{Total kilocalories}} \times 100$	40.0	35.4	36.0

[1] 1 gram of fat is equivalent to nine kilocalories[55]

APPENDIX I

Percentage of males and females with "inadequate" intakes of nutrients according to standards developed by Nutrition Canada[16]

Nutrient	Male (%)	Female (%)
Protein	3.0	6.9
Calcium	3.0	4.6
Iron	6.1	20.7
Vitamin A	3.0	5.7
Vitamin C	3.0	4.6
Thiamine	9.1	6.9
Riboflavin	6.0	6.0
Niacin	30.3	33.3

APPENDIX J

Effect of supplementation on vitamin A and niacin intakes for subjects in the Alliance of Youth and the Elderly and Meals on Wheels

	Vitamin A (I.U.)		Niacin (mg.)	
	Alliance of Youth and the Elderly	Meals on Wheels	Alliance of Youth and the Elderly	Meals on Wheels
Number of Individuals	7	8	10	7
Total Amount Supplemented	54,600	65,500	615	170
Average Supplement per Individual	6,825	9,357	62	24
Group Mean Without Supplementation	7,003	8,627	12	12

APPENDIX K

Effect of supplementation on recommended[15] levels of nutrient intakes for three individuals

Individual Number	Nutrient Intake Levels Greater than 67 Percent of Recommended Intakes	
	With Supplementation	Without Supplementation
46	5	0
50	8	4
53	7	1

APPENDIX L

Tryptophan contribution to niacin intakes for males and females in all groups

	Alliance of Youth and the Elderly		Meals on Wheels		Sherbrooke Community Centre	
	Male	Female	Male	Female	Male	Female
Mean Protein Intake (g)	69	61	62	50	75	64
Tryptophan[1] (mg)	690	610	620	500	750	640
Niacin Equivalent of Tryptophan[2]	12	10	10	8	13	11
Niacin Intake	16	26	15	24	11	10
Total Niacin Equivalents (N.E.)	28	36	25	32	24	21

[1] Tryptophan is approximately equal to one percent of total protein[55]

[2] 60 milligrams of tryptophan equal one niacin equivalent (N.E.)[55]

APPENDIX M

Data Bank

A computer tape of The Handbook of the Nutritional Contents of Foods[69] listing approximately 2500 foods formed the basis of analysis for foods in this survey. The Handbook[69] consists of three separate tables. All foods in the present survey were analysed from Table I, the amount of nutrients for 100 grams of edible portions of food. Values are given for energy (kcals), protein (g), fat (g), calcium (mg), iron (mg), vitamin A (I.U.), vitamin C (mg), thiamine (mg), riboflavin (mg) and niacin (mg).

The Handbook[69] is considered to be representative for each food item after taking factors such as variety, stage of maturity, seasonal and geographic differences into account. In the Handbook consideration is also given to trimming, manufacturing, production and other preparatory procedures. Data for the Handbook were gathered from analyses performed by scientists in universities, government laboratories and in industry.

Edible portions of foods are those parts of food normally eaten in the United States. Exact descriptions of foods are given. The procedures used for determining the nutrient contents of the various foods are given in the appendices of the Handbook[69].